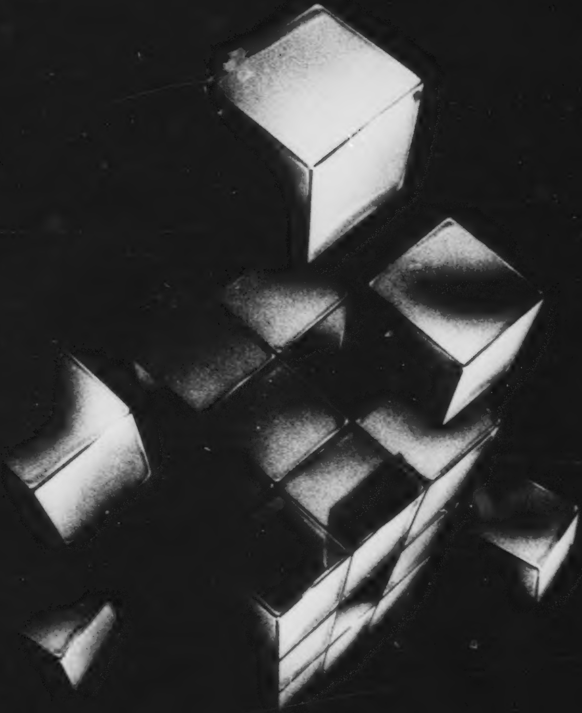

Competing in the New Global Economy

Report of the Premier's Council
Industrial Policy Studies
Volume III

90-00305

Report of the Premier's Council
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PREFACE

This is the final volume of background studies to the main report of the Premier's Council, *Competing in the New Global Economy*. Volume I summarized the research findings of the Council, articulated the major challenges facing Ontario, and presented the Council's recommendations to improve the competitiveness of the Ontario economy. Volume II contained in-depth industry sector studies, research on entrepreneurship, and a case study on Ontario Hydro. Volume III contains summaries of the remaining research on how existing economic development policies in Ontario compare to those in other parts of Canada and elsewhere in the world.

In searching for new policy and program options for Ontario, the Council asked its consultants and staff to study selected economic policies in other jurisdictions, including Quebec, British Columbia, the United States, Sweden, France, West Germany, the United Kingdom, the European Economic Community, Japan, Korea, and Singapore. Subcommittees of the Council also travelled to Japan and West Germany to gather first-hand knowledge of the process and substance of industrial policy-making in those jurisdictions. The result of these studies is a unique set of findings on the relative effectiveness of different industrial policy approaches in various economic circumstances.

While the Council was wary of the pitfalls of trying to adopt wholesale what works in other, very different cultures, there was recognition that Ontario could learn from what others are doing. In a few cases, successful programs from abroad became the inspiration for the Council's recommendations. In other cases, foreign failures gave pause to ideas the Council was considering and resulted in major improvements in the policy or program proposals it did put forward.

Throughout this report, the emphasis is on how Ontario's approach can be improved. There are, of course, areas where Ontario and federal programs have been successful, and those are noted as well. The Council has been mindful of the lessons to be learned from these positive Canadian efforts in its structuring of new Ontario initiatives.

Volume III elaborates on the logic and roots of the Council's thinking as presented in Volume I. This volume summarizes current Ontario and federal industrial policies, comparing them to the most successful policies identified abroad. The volume is organized according to key themes from the Council's main report. Chapter I begins with a summary of the characteristics of Canadian industrial policy and the lessons learned from studying both successful and unsuccessful industrial policies in other countries. Chapter II looks at how the problems associated with industrial restructuring are handled in Ontario and Canada as a whole, then highlights some of the most useful approaches adopted in other jurisdictions. Chapter III reviews domestic policies for high-growth and emerging industries and compares them to what is best practice abroad. Chapter IV assesses Canadian approaches to aiding entrepreneurs, contrasting these efforts with what has happened elsewhere. Chapter V discusses the inadequacy of Canadian science and technology policies in light of the aggressive and successful mobilizations underway abroad. Finally, Chapter VI presents a comparison of Ontario and Canadian training strategies and the approaches of other countries.

Volume III was prepared by the Council's consultants, their associates, and the staff of the Premier's Council Secretariat. Altogether, more than one thousand industry, academic, labour, and government officials were interviewed during the research effort that produced the three volumes. Organizations interviewed during the course of the research effort are listed in Appendix A.

The Council acknowledges the outstanding work of its consultants, The Canada Consulting Group and Telesis, and the members of the Premier's Council Secretariat in carrying out this research effort. These individuals (who are listed below) worked as a single team serving the Council's interests. Special appreciation must also be extended to Kathryn Randle who assisted in editing this volume for publication.

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CHAPTER I
THE INGREDIENTS OF GOOD INDUSTRIAL POLICY

The role of government in economic development depends upon the particular circumstances in which an economy finds itself. An economy characterized by strong companies, which have international competitive advantages in their businesses and invest steadily to restructure themselves, needs little in the way of government support. On the other hand, a country with few strong indigenous companies to generate substantial export earnings needs significant and constructive involvement by government to raise the living standards of its people. Switzerland may have little use for industrial policy; Singapore manifestly needs one. The strengths and weaknesses of a particular economy therefore dictate what role, if any, government should play in that economy.

The key to formulating and implementing successful industrial policies is strategic pragmatism. Successful policies are pragmatic efforts to enhance industrial competitiveness in light of global market realities. All good industrial policies are tempered by the business realities of competition, whether those be technology, production scale, market demands, financing, trade relations, or other factors. The main test of a good policy or program is whether it results in healthy, profitable firms able to succeed in world markets because they possess sustainable competitive advantages over other businesses. Such firms constitute the wealth-creating backbone of an economy. They are the source of high-paying factory and office jobs, and through their purchasing activities and spin-offs they create and support large numbers of other firms.

Wealth creation is not the only public goal that can be met through government involvement in economic development. For industrial adjustment to proceed as smoothly as possible, it must combine attempts to minimize human disadvantage and loss of living standards with the goals of building a healthy economy. Moreover, economic development policies must also take account of the redistributive aims of government, including regional development priorities. Good industrial policies must integrate these social concerns with the overarching goal of enhancing the economy's capacity to create wealth.

The comparative research commissioned by the Premier's Council on economic policies in Ontario, Canada, and abroad is the subject of this volume. This chapter sets a context for the rest of the volume by summarizing the current domestic industrial assistance framework, identifying its shortcomings, and pointing out the general lessons the Council has discovered about what makes for good and bad industrial policies.

CURRENT CANADIAN POLICY

Government has always played a strong role in economic development in Canada. Ever since the federal government backed the Canadian Pacific Railway in the 1880s and later created national tariff policies to protect Canada's infant industries, governments in Canada have taken a strong hand in creating the infrastructure and policies necessary to foster an industrial economy. Today, there are a plethora of federal and provincial development programs (the major ones are listed in Exhibit I.1). Sorting through the disparate and sometimes contradictory objectives of these programs is a daunting task. Determining where the money is actually being spent and what effects the assistance is having is even more difficult.

In the course of research conducted for the Premier's Council, access to raw data on federal and provincial industrial assistance funding was obtained. Analysis of the pattern of government funding yielded an understanding of the effects of government policies. This research was summarized in Chapter III of Volume I, where the major problems with current government industrial assistance programs were elaborated. These included:

- **The problem of indiscriminate focus**—programs fail to take into account the vital distinctions between high and low value-added businesses and traded and non-traded businesses.
- **The problem of mixed social and economic objectives**—programs confuse regional development and small business assistance objectives with wealth creation priorities.
- **The problem of misapplication of funds**—too much emphasis is placed on fixed asset incentives, which are of little use to many high-growth industries, and on ad hoc corporate bailouts that do not address the long-term restructuring needs of mature sectors.

Each of these problems pervades the pattern of industrial assistance programs in this country. Restructuring efforts in core industries are plagued by the ad hoc nature of most government restructuring assistance and the lack of incentives to move to higher value-added production. High-growth and emerging indus-

EXHIBIT I.1

THE MAJOR FEDERAL AND ONTARIO INDUSTRIAL POLICY MECHANISMS

Selected Industry Programs	Mandate	Main Funding Mechanism
Ontario		
Ontario Development Corporations	• Encourages and assists in development and diversification of industry in Ontario through lending and investment activity; focus on business start-ups, expansions, high-risk ventures, and regional development	Loans
Innovation Ontario	• Assists newer ventures requiring funds for new product and prototype development	Equity
Canada		
Federal Business Development Bank (FBDB)	• Promotes the development of small and medium-sized businesses through financial and management services	Loans
Small Business Loans Administration (SBLA)	• Guarantees loans of 85 per cent of the value of chartered bank loans to businesses with under $2 million in revenue	Loan Guarantees
Industrial and Regional Development Program (IRDP)	• Promotes regional industrial development through financing to private sector; responds to needs of small and medium-sized businesses in particular	Loans & Grants

EXHIBIT I.1 (cont'd)

THE MAJOR FEDERAL AND ONTARIO INDUSTRIAL POLICY MECHANISMS

Selected Industry Programs	Mandate	Main Funding Mechanism
Export Development Corporation (EDC)	• Provides incentives for foreign purchasers to buy Canadian capital goods and services by financing up to 85 per cent of the Canadian contract value	Low-Interest Loans
Program for Export Market Development (PEMD)	• Encourages firms to export by sharing the risks of entering new export markets	Forgivable Loans
Defence Industry Productivity Program (DIPP)	• Develops and maintains strong Canadian defence-related industries capable of competing in domestic and export markets	Forgivable Loans
Industrial Research Assistance Program (IRAP)	• Makes available grant contributions for research and development	Grants
Other Assistance (Ontario and Federal)		
Corporate Bailouts/Industry Restructuring	• Provides short-term assistance to individual companies undergoing financial difficulties using grants, low-interest or interest-free loans	Low-Interest Loans
Tax Incentives (Mainly Federal)	• Provides deductions, accelerated depreciation, and/or tax credits for selected investments in capital equipment, R & D, and other areas	Tax Deductions & Credits

Source: Canada Consulting Group and Telesis interviews and analysis tries receive much less assistance than their economic importance and often difficult competitive positions appear to warrant, and many of them are unable to use available incentives, which are heavily weighted towards fixed asset investments. Threshold companies in export industries find little in the way of government risk-sharing funds available for new product development or the creation of marketing organizations abroad, while millions of government dollars are spent on assistance to non-traded industries and businesses too small ever to have a realistic chance of selling outside Canada.

These problems with Canadian industrial assistance programs are compounded by shortcomings in other areas of government policy, including procurement, research and development funding, skills training programs, labour adjustment efforts, and the education system. It is impossible to address the competitive position of Ontario industry without looking at all the areas of public policy that contribute to or exacerbate its weaknesses. Each of these areas was examined individually in Volume I. But the problem underlying them all is the lack of strategic focus on the critical issues that need to be addressed.

There are at least four ways in which strategic approaches to industrial policy are lacking:

- insufficient competitive analysis as a basis for policy;
- the ad hoc, short-term orientation of most policy-making;
- the inadequate focus on points of competitive leverage in most programs;
- the poor linkage among different policies.

Lack of Competitive Analysis

Few Ontario or federal policies and programs are based on sound analysis of the competitive situation facing Canadian industry. Good analysis is fundamental to understanding the real nature of the competitive problems facing an industry and to developing policies that are effective and cost-efficient. Such analysis must include an understanding of the cost structures and main competitive drivers of businesses, the cost position of Canadian firms relative to competitors in international markets, and key competitive differences between Canadian companies and others in terms of market share, production scale, product mix, price premiums attained, technology, and other relevant factors. This kind of analysis, which is commonplace in countries like Japan or West Germany, is rarely done in Canada. In short, good industrial policy cannot be developed with macroeconomic indicators.

Ad Hoc, Short-Term Policy-Making

Very few Canadian economic programs have been developed after thorough study and industrial consultation. Typical of most programs is an ad hoc or reactive approach to crises or opportunities. Governments spend a high proportion of their time responding to companies that are verging on bankruptcy or chasing businesses that have indicated they might locate a plant in Canada. The problem with both approaches is that longer-term objectives are not established and opportunities for advancing the development of indigenous Canadian multinationals are not addressed. The critical needs of threshold companies in product development and marketing require a long-term perspective on policy making. Strategic investments, by their very nature, must be planned well in advance.

A strategic approach to procurement, for example, requires identifying opportunities to develop Canadian suppliers years in advance of the actual procurement process. Both the Ontario and the federal governments have not been particularly adept at taking a long-term view of procurement, which would require early identification of sourcing opportunities, an understanding of the technological capabilities of Canadian industry, and analysis of the structure of global competition in critical product areas. (See Volume I, Chapter V.)

The problem of short-term focus is also evident in the federal approach to funding research and development. Lip-service is paid to raising Canada's level of R & D expenditures as a percentage of GDP from 1.4 percent to something more in keeping with spending by other advanced industrial economies. But government departments and agencies have been reluctant to take responsibility for identifying the industrial priorities for the pre-competitive research that must underpin and direct higher levels of R & D spending. In Europe, Japan, and the United States this process of longer-term priority setting in R & D is much better developed. And in all those jurisdictions, massive pre-competitive R & D efforts are underway in key technological areas. Such initiatives are geared to the development of products whose market debut may be many years away, but they are nevertheless necessary first steps in creating the capability to manufacture and market high technology goods in the future. It has been difficult to build consensus mechanism in Canada for setting such R & D priorities and, as a result, few pre-competitive research programs of any consequence have been developed.

Inadequate Focus On Points of Leverage

The third general problem with Canadian industrial policies is that they are rarely targetted at the points of real competitive leverage. Incentives, when they are available, are broadly-based and are not focussed on addressing specific competitive weaknesses.

For example, the development of computer companies in Canada has been assisted by all manner of direct financing through R & D tax incentives, loans, grants, and sometimes even equity investments. Nevertheless, one of the most critical points of competitive leverage for computer firms—that of developing and testing prototypes—has never been the focus of specific incentives. Federal government computer procurement, which has tried to favour Canadian firms, has not been directed at the prototype stage, nor have other more direct assistance programs. The government of Japan, by contrast, focussed its very effective computer industry strategy on assisting the development of prototypes and accelerating product life cycles through its leasing incentive program. (See Chapter III of this volume.) This proved to be a highly strategic way to use government funds to accelerate the development of a critical industry. The Japanese computer industry was able to turn over its product more quickly and accelerate the product development learning curve, thereby making up for some of the competitive disadvantages it had relative to the U.S. computer industry.

Instead of this targetted approach, most Canadian economic development programs tend to offer broad-brush funding of industrial activities. Focussing on points of competitive leverage would result in more effective policy—and at a lower cost to governments.

Poor Linkage Among Policies

A final underlying strategic problem is that industrial policies in Canada are seldom linked in such a way that they support one another's aims. Procurement policies should be tied to industrial restructuring activities. Applied research in universities and government labs should be tied to industrial needs as far as possible. In each of these cases and many others, the linkages among Canadian industrial policies are not strong.

Chapter III of this volume details Ontario's ICON educational computer story, a very clear case of poor linkage. A tremendous investment by the province in the development of an educational computer was largely wasted from an economic development point of view because of poor linkage between the industrial development agencies of the government and the ministry which sponsored ICON.

These shortcomings of current Canadian industrial policy will not be remedied quickly or easily; a significant change in attitudes will be required at all levels of government. Strategic thinking, based on knowledge of the competitive realities facing Canadian industry, must become commonplace. Long-term policy goals and priorities must be developed in concert with industry, the scientific establishment and other key players. Strategic pragmatism must replace the short-term, politically expedient approach to development that is all too common in Canada today.

WHAT MAKES FOR GOOD INDUSTRIAL POLICY

As part of the Premier's Council research program, industrial policies in other countries were reviewed with an eye to identifying what kinds of policies generally work and what kinds generally do not. Most countries have an array of industrial assistance programs that appear effective on paper, but very few of them are truly successful in meeting the competitive needs they aim to serve. In analyzing the most successful programs such as Sweden's Industrifonden, Japan's computer leasing program, or the European Community's Esprit pre-competitive research program, a common set of workable features could be identified.

Common Ingredients Of Successful Industrial Policy Mechanisms[1]

- Continuity of programs despite changes in political leadership;
- A pragmatic rather than ideological approach to policy development;
- Incentives directed towards traded industries, not sheltered ones;
- Focus on international competitiveness as the driving discipline for action;
- Decentralized identification of market opportunities (companies rather than bureaucracy), except when government is a key purchaser;

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[1] Based on Telesis and Canada Consulting Group review of industrial policies in various countries.

- Focus on building strong companies capable of competing internationally;
- Provision of incentives on a matching basis to companies;
- Structuring of incentives to address specific competitive leverage points.

Very few Ontario or federal industrial policies follow these rules of thumb. Many Canadian programs do not draw a distinction between traded and non-traded industries (see Chapter III, Volume I), and rarely does international competitiveness act as the driving discipline for action by governments. Increasingly, programs do seem to take account of the need to have market opportunities identified by companies, and there is growing recognition that matching incentives increase the likelihood that companies will use any assistance effectively. However, few existing programs are premised on the need to build strong international companies and to focus incentives very directly on specific points of competitive leverage where the assistance can achieve the best results.

In developing its recommendations to government, the Premier's Council drew heavily on these policy lessons. All the programs recommended by the Council were focussed on traded sectors and premised on needs identified by analyzing the international competitiveness of Ontario industries. Programs like the Early Stage Venture Capital Incentives (Recommendation 9) and the Initial Public Offering Incentive (Recommendation 10) were designed with the idea that private sector venture capitalists and stock market investors will do a better job of identifying opportunities than a government-directed venture capital fund can. Ontario's experience with a government-run venture fund was neither a productive way to spend public funds nor a market-responsive way to assist new business.

Other recommendations of the Council, like the Ontario Risk-Sharing Fund (Recommendation 7) and the Ontario Recapitalization Incentive Plan (Recommendation 1), were designed to assist threshold firms become stronger and more capable of competing against major foreign multinationals. This is very much in keeping with the orientation of the successful programs looked at abroad.

Finally, the Council's recommendations are focussed on the clearest points of competitive leverage that could be identified. In the case of high-growth industries, these were tax credits for R & D spending and a major strategic procurement effort. In the case of threshold firms it was sharing the risk of new product development. In the case of building the science and technology infrastructure, it was the Centres of Excellence program.

Policies With A Generally Good Record

In designing its program proposals, the Council looked at the kinds of specific policy mechanisms that have worked well in most countries. These are listed in Exhibit I.2 and include programs that are aimed typically at the specific points of competitive leverage of high-growth industries (procurement, product development, prototype development, and overseas marketing), as well as programs that attempt to meet specific industry-defined competitive needs that are not easily addressed by companies acting alone (applied research and customized training). In countries like Japan and France, all of these policy mechanisms are being used to good effect. In the United States only the technology procurement lever (through the Department of Defense) and applied research institutes are used extensively. Much the same is true of Canada, although Ontario has developed customized training programs.

Some of these successful policy mechanisms were adapted by the Council in designing the recommendations contained in Volume 1. However, these policies were always tailored to the specific circumstances of the Ontario economy. What works in one place may not be appropriate somewhere else. In devising its Ontario-specific policies, the Council drew only on those ideas from abroad that were clearly relevant to the competitive issues facing the province.

Policies With A Generally Poor Record

Analysis of industrial policies in various countries also indicates the kinds of policy mechanisms that ought to be avoided. Five of the most common are listed in Exhibit I.3. Unfortunately, many similar initiatives have been used to ill-effect in Canada.

Much of the regional assistance funding in Canada is broadly available, not targetted as the most successful foreign programs are. In fact, all regions except Southern Ontario and Ottawa are eligible for certain types of regional assistance. The problem with broad-based programs is that they spread their effects so widely that no region can use them to get a healthy critical mass of activity going. If almost all regions qualify for regional assistance, then the ability of truly depressed regions to take advantage of incentives is diminished.

In the area of restructuring incentives, government bailouts of companies with poor market prospects are a common problem.

EXHIBIT I.2

INDUSTRIAL POLICY MECHANISMS USED IN SELECTED COUNTRIES

Policy Mechanisms	Countries That Use Mechanism Effectively						
	U.S.A.	Sweden	West Germany	France	U.K.	Japan	Canada
Government procurement leverage for technology-based industry development	●[1]	●	●	●	●	●	●[2]
Conditionally reimbursable loan mechanisms for new product development		●		●		●	
User prototype financing incentives				●		●	
Applied research institutes jointly sponsored by industry, government and universities	●	●	●	●	●	●	●
Incentives for overseas market investments		●	●	●		●	
Customized training programs in industry		●	●	●	●	●	●[3]

1. Mainly Department of Defense.
2. Used well federally only in the defence area and in Quebec in computer system software and consulting engineering services.
3. Ontario offers this; federal government does not.

Source: Telesis and Canada Consulting Group interviews in various countries.

EXHIBIT I.3

INDUSTRIAL POLICY MECHANISMS WITH A POOR RECORD IN MOST COUNTRIES

Policy Mechanisms	*Examples*
• Regional assistance programs that are not sufficiently targetted	German regional programs
• Continued bailouts of firms with no market prospects	Swedish shipbuilding pre-1982
• Trade protection not linked to specific industrial restructuring actions	U.S. in textiles, steel, autos
• Government pushed entries into new high-tech fields	France in computers
• Export subsidies applied equally to all exports without regard to competitiveness	Israeli duty drawbacks and exchange rate insurance programs

Source: Telesis and Canada Consulting Group, based on interviews in various countries

Moreover, trade protection for industries in difficulty is often not linked to specific industrial restructuring actions. There are exceptions, like the footwear industry, but these are few.

Canada has also struggled with government-backed high technology efforts like Telidon, and Ontario has encountered some of the same problems in the financing of the biotechnology firm, Allelix. When government takes on a procurement role, it can be very effective in pulling high technology firms along. As a procurer, government is acting as a legitimate part of the market and thus can give firms the proper guidance and market feedback to enhance their competitiveness. However, when government acts as a pusher of high technology without also being a procurer, it runs a great risk of misunderstanding what markets really need. France, perhaps more than any other country, has learned the hard lesson that "government-push" strategies in areas like computers usually do not work.

The major benefit to Ontario of reviewing the industrial policies and programs used elsewhere is to enhance the effectiveness of the industrial policies the province adopts in the future. This chapter has reviewed the general industrial policy lessons the Council learned from other countries. The following chapters look at specific policy ideas from abroad in areas of particular relevance to Ontario's economy.

CHAPTER II

POLICIES TO SMOOTH INDUSTRIAL RESTRUCTURING

All developed economies eventually face the challenge of restructuring failing industries, whether because individual companies become uncompetitive or entire sectors of the economy fail to measure up to the demands of the international marketplace. The new global economy has intensified the need for governments to participate in the development of restructuring policies and programs.

No longer do nations, provinces or other economic units have the luxury of hiding behind trade barriers or assuming that factors which have historically provided a competitive advantage will continue to do so. The ease of technology transfer, the shrinking of transportation costs as a component of total cost, and the rapid industrialization of low-wage areas all ensure that developed countries will continue to experience the decline of traditional sources of economic strength.

It surprises many people to learn that even Japan, usually regarded as the preeminent role model for economic success in the postwar world, has had to learn how to cope with serious problems of declining industries. While Japanese industries such as automobiles, consumer electronics, and machine tools have become universally respected success stories, other important sectors of the Japanese economy, including textiles, shipbuilding, and aluminum smelting, have seen rapid growth replaced by spiraling decline. The reasons are familiar to all developed economies: changing cost structures caused by factors such as energy price fluctuations and the entry of new, low-wage countries as formidable competitors.

Europe and North America have faced similar challenges and have responded with a variety of tools to try to ease the transition; these range from massive subsidies bailing out troubled firms to training programs and extended unemployment benefits for workers who have lost their jobs. While the process varies among jurisdictions and individual industrial sectors, restructuring generally entails substantial labour adjustment, a movement away from manufacturing low value-added products, and increased investment in plant and equipment, research and development, and marketing.

CHALLENGES AND LESSONS FOR ONTARIO AND CANADA

Ontario's resource-based and mature industries, which are responsible for creating much of the province's existing wealth, are facing unprecedented competitive pressures from a variety of sources. Slower growth in the demand for traditional products, rapid technological advances in production techniques and product innovation, and the accelerating rise of aggressive new players in world markets are forcing these industries to restructure in order to maintain their profitability and their position in the province's economy.

The success with which an economy can undertake the task of modernizing industries and re-equipping the labour force with new skills will significantly influence its ability to generate future wealth and employment opportunities. This chapter looks at how other jurisdictions have taken a systematic approach to this problem and analyses federal and provincial restructuring policies in Canada.

A review of relatively successful restructuring policies and programs in other jurisdictions yields several important lessons for Ontario policy-makers. The following are some of the most meaningful messages conveyed by restructuring attempts in other countries:

- A successful restructuring program reflects a coalescence of government, labour, and private sector interests and efforts.
- While most jurisdictions have had experience with providing massive government funds to bail out failing companies, in the long run this approach has been found wanting. The most successful programs rely more on government leadership than on government money.
- Successful government programs are most often administered by small expert teams of quasi-public servants, who are able to do exceptional independent analysis of the competitive dynamics of a business and who enjoy a degree of public support and respect that would be unusual in North America.
- Behind most successful programs, there is some entity—either public or private—with the skill and the clout necessary to negotiate a solution that shares the miseries. This is a more important element of success than legislated authority to impose solutions.
- It is important to define the conditions that will bring a restructuring effort into play and to develop accepted criteria as to which individual companies and/or industrial sectors will receive attention and be eligible for help.

- Restructuring policies should rest upon a foundation whose long-term goal is the health of the economy, not just propping up weak companies on an ad hoc basis.
- Programs aimed at specific sectors have the greatest chance of improving the overall standard of living of a jurisdiction, but they will be successful only when all major players in the sector agree there is a problem that may require sacrifices by all.
- Unemployment benefits should be viewed as a last resort, not a key restructuring program. Training, re-employment subsidies, and a variety of other programs will have a more positive overall effect.

THREE MODELS OF INDUSTRIAL RESTRUCTURING

While restructuring programs often have basic similarities, the methods of developing a restructuring policy are as varied as the governments that propose them. This chapter focusses on three examples, each of which demonstrates a different philosophy for ailing industries to receive assistance through government initiatives and programs. The responses of the three countries selected—Sweden, France and Japan—to restructuring are different in important respects, but taken together they demonstrate many of the lessons for Ontario and Canada listed above. Each could be seen as an argument for a different model for restructuring:

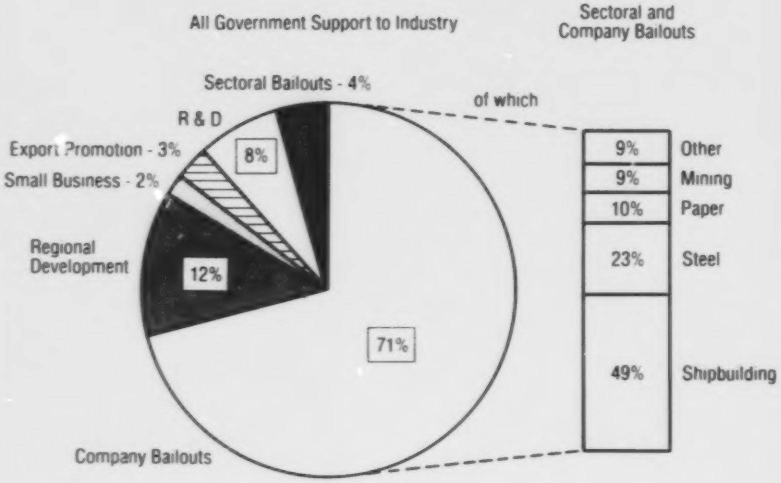
- Sweden's experience represents a 'Focus on the Worker' model.
- France, on the other hand, created an agency that exemplifies a 'Focus on the Company' model.
- Japan's policies demonstrate a 'Focus on the Sector' model.

In comparison to most North American restructuring efforts, the models discussed here are generally structured broadly to deal with problems as they arise or can be foreseen, rather than being reactions to specific crisis situations. In addition, each is now part of a long-term national industrial policy whose aim is to strengthen the economy's ability to compete internationally in key sectors. The role of restructuring policies and programs within an overall economic development policy is to help convert problem sectors into competitive sectors, or to lessen the pain of individual workers caught in industries that must be downsized as international competitive pressures take their toll.

EXHIBIT II.1

THE COMPOSITION OF GOVERNMENT SUPPORT TO SWEDISH INDUSTRY

1975-1981



Note Bailouts were costing over $1 billion annually by 1982
Source Telesis interviews and analysis

THE SWEDISH EXPERIENCE WITH INDUSTRIAL ADJUSTMENT

A Focus on the Worker

Prior to the late 1970s, Sweden enjoyed a strong international competitive position in many high-value industries. Its success was based on an excellent natural resource base in wood and iron ore and an entrepreneurial tradition that had led to the formation of large companies in traded businesses.

Beginning around 1977, however, the Swedish economy encountered new competitive challenges that began to erode the high living standards its citizens had become accustomed to. Most important, as raw materials-based industries became increasingly internationalized, new competitors threatened Sweden's wood and iron sectors, and Sweden's strong positions in steel and shipbuilding were rocked by competition from Japan and low-wage countries.

Sweden's initial policy response to these challenges relied heavily on bailout assistance; government spending on bailouts rapidly grew to more than $1 billion by 1982. Between 1975 and 1981 company and sectoral bailouts accounted for 75 percent of all Swedish government financial assistance to industry (see Exhibit II.1). The national leadership eventually realized, however, that Sweden's only hope was to strengthen other sectors of the economy that would be able to build and maintain competitive advantages in world markets. While recognizing that traditional core industries must be allowed to wither, the government was determined to ease the transition with adjustment efforts in line with the country's long-standing commitment to full employment.

Ultimately, Sweden dealt with the structural problems in three ways:

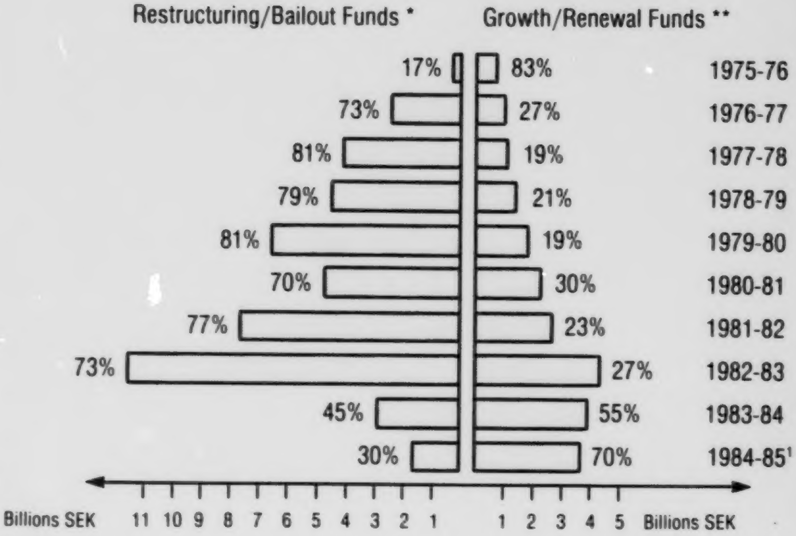
- Significant cutbacks were made in the production of steel, iron ore, and ships. Regional investment incentives and retraining programs were used to ease these transitions.
- A significant currency devaluation was taken relative to the U.S. and Canadian dollars to buy time for the forest products industry and to increase profits for industries, such as the auto industry, that export to the U.S.
- Policies to increase new product development and to assist in overseas marketing were developed to accelerate growth in the healthy engineering and chemical sectors. These included the creation of an industrifonden (product risk-sharing fund), an export credit and insurance program, and increased R & D spending.

These measures ultimately resulted in rapid growth in the more competitive segments of the Swedish economy and allowed a significant reduction in the amount of money going to corporate and sectoral bailouts (see Exhibit II.2). Swedish labour adjustment, retraining, and regional policies helped ease the flow of labour from the declining sectors to the growth areas.

Swedish industrial adjustment policies and programs for restructuring are wide-ranging and take many forms, including relief work, training, industry subsidies, redundancy pay, investment reserves, and recruitment subsidies, to name a few. The Swedish model for administering adjustment policy is based on close and active tripartite cooperation among labour, company management, and public sector representatives. This structure has helped generate a long-term commitment to solving adjustment problems and, particularly, to maintaining the principle of full employment in labour market policy programs.

EXHIBIT II.2

SWEDISH INDUSTRIAL SUPPORT FOR RESTRUCTURING
COMPARED WITH RENEWAL
1975-85



* Restructuring/Bailouts = temporary support + sectoral support programs
** Growth/Renewal = R & D support + regional policy support + export support
+ small business support

[1] Does not include extraordinary one time ship buy back of about SEK 3 billion
Source Swedish Ministry of Industry

The Government Responsibility For Labour Adjustment

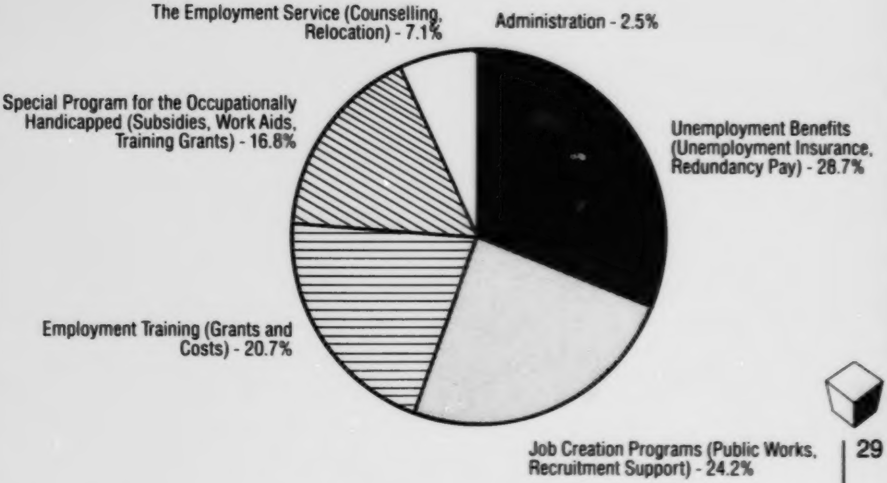
The Labour Market Administration, a central government agency created in the 1940s, has overall responsibility for all labour market policy programs, including adjustment. The Employment Service, which consists of 290 offices across the country, is one of three authorities within the Labour Market Administration and functions as the local agency for general labour market issues, including adjustment services. It is responsible for public placement services, vocational counselling and rehabilitation programs (Exhibit II.3).

Swedish policy on labour market adjustment is deeply entrenched in legislation. In 1974, the *Act on Security of Employment* came into effect, requiring a minimum of one month's notice

EXHIBIT II.3

THE SWEDISH LABOUR MARKET ADMINISTRATION
Labour Market Policy Resources

Total: Millions SEK 21,757



Source: Swedish Labour Market Administration Annual Report, 1985-86.

from both employer and employee before termination of employment. During this period of notice, an employee is entitled to full pay. The law also specifies priority rules in cases where an employer wishes to dismiss or lay off workers because of lack of work. The *Act Covering Certain Employment-Producing Measures*, enacted at the same time, stipulates notice periods of two to six months in cases of production cutbacks; the notice in this case is to a County Labour Board.

Since 1976, the mandatory listing of jobs lasting more than ten days has been enshrined in legislation. This has expanded the range of job openings, attracted more job seekers in all occupations, improved the ability of the Employment Service to serve more groups, and enhanced the job planning function of the Labour Market Administration.

Labour Adjustment Policies and Programs

A number of policies and programs are included within the area of labour adjustment. Selected examples of policies used during the recession of the 1970s are provided in Exhibit II.4.

Mobility grants have been used since the late 1950s for employees who accept a job referral by the Employment Service in another location as a result of labour market conditions. Employees have been eligible for various types of relocation grants over the years, with about 20,000 receiving such assistance annually. Relocation grants average about SEK 15,000 per household.

Relief work for the unemployed has been used in various forms as a labour market program to create jobs when unemployment is high. An unemployed person is placed in a relief job for no more than six months and only after the Employment Service has attempted to find regular employment or a training program. Relief work in the private sector has been largely replaced by recruitment subsidies.

Recruitment subsidies are intended as an incentive to companies to expand their regular hiring. These subsidies, which amount to 50 percent of labour costs for a maximum of six months, are of particular benefit to the long-term unemployed. In 1984, recruitment subsidies were approved for 30,000 workers, but this declined to 12,000 in 1985. Expenditures on this program accounted for 3.3 percent of the Labour Market Administration's budget.

Labour market training has been targeted mainly to unemployed adults. There are 50 labour market training centres and 70 branch centres located in Sweden. Training is free, and a grant covers the cost of course materials. Trainees also receive a taxable stipend, indexed to the inflation rate, that varies with entitlement to unemployment benefits. Follow-up studies of people who have undergone labour market training show that 60 to 70 percent of those who completed training found jobs within six months.[1] Roughly 100,000 job seekers took employment training in 1985-86 (excluding in-house training), with annual expenditures currently accounting for 21 percent of the Labour Market Administration's budget.

Redundancy pay is a new measure financed by the Labour Market Administration. An employee who is laid off is now entitled to redundancy pay from the employer, who can obtain a state grant for this purpose.

Unemployment benefits are not a cornerstone of the Swedish approach to labour adjustment because Swedish labour market polices are geared to sustaining full employment. Unemployment

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[1] Bo Jangenas, *Swedish Approach to Labour Market Policy*, 1985-86.

EXHIBIT II.4

SELECTED SWEDISH LABOUR ADJUSTMENT POLICIES

1970s to 1980s

Time Period	Type Of Grant	Purpose	Description
1975-79	Stockpiling subsidies	Prevention of job cutbacks	Payable to companies with declining production; subsidies amounting to 20% of increased value of inventories during one year; 25,000 jobs or 0.5% of the labour force, were preserved
1975-80	Older worker subsidy in textile and garment industry	Easing of job cutbacks	Available to companies that planned major cutbacks in manpower on the condition that surplus personnel could be employed outside of the companies' regular production
1975-87	Respite orders	Temporary maintenance of employment levels	Encourage local and national government agencies to place industrial orders earlier than originally planned. Used in situations where employment services have needed more time than usual period of notice given to employees before production cutbacks in order to help them find other jobs
1976-87	Subsidies for in-plant training programs	To use training as an alternative to dismissal or layoff	Participants, who must be current employees of company, receive wages in accordance with prevailing collective bargaining contracts

Source: Canada Consulting Group and Telesis, based on interviews in Sweden and published sources.

EXHIBIT II.5

COMPARISON OF CANADIAN AND SWEDISH UNEMPLOYMENT INSURANCE BENEFITS 1985

Country	U.I. Benefits	Income Maintenance Beyond U.I.	Training
Canada	• For twelve months (365 days); longer if in training; 50% of previous wage	• Workers 55-64 years; with ten years' tenure on permanent layoff	• Use of public and private institutions
Sweden	• 300 days if under 55 years; 450 days if 55+; 80% of previous wage	• Agreements must be negotiated	• Public sector compulsory

Source Canada Consulting

benefits represent a last-resort relief measure, used only after all other avenues for reemployment have been exhausted (Exhibit II.5).

Restructuring Using Investment Reserves

Investment reserves represent another measure to assist the adjustment process. During boom periods, companies are encouraged to set aside part of their profits in counter-cyclical investment reserves, which are tax-exempt. During a recession, companies can apply to the Swedish Cabinet for permission to take funds from these reserves for investment in construction, land, machines, and regional development.

Corporations may allocate up to half their profits to this general investment fund. This amount is tax-deductible as long as half of it is deposited in a special interest-free account in the Riksbank. When it decides to use the fund, a company immediately becomes entitled to additional deductions of 20 percent for machinery and 10 percent for other capital expenditures. Improper use of an investment fund renders it taxable and subject to an additional 20 percent of the amount concerned.

Such a tax reserve fund is a useful model for providing assistance in the restructuring process. This model could be applied in other jurisdictions by having companies draw on such a fund for the purpose of investing in higher value-added restructuring or rationalization initiatives in their industries.

INDUSTRIAL RESTRUCTURING IN FRANCE

A Focus on the Company

During the decade between 1974 and 1983 the French government took a leading role in attempting to drive the economy, with mixed results. The policy makers had some success with major national efforts such as development of the Concorde, a semiconductor program, production of computer peripherals, and strengthening the machine tool industry.

But a long history of operating in a sheltered economy—provided by a protected home market and France's privileged export status in former colonies—had done little to prepare French companies for the realities of international competition in the late 1970s. While some of the high-profile national programs were enjoying a measure of success, the country's basic industries were in an inexorable decline. Steel, coal, shipbuilding, petrochemicals and textiles employed a high percentage of French workers. But the small and medium-sized companies—of marginal scale by international standards—that formed the backbone of many of these sectors were failing at an alarming rate.

It was not until 1984 that the government began to pull back from a policy of trying to save all companies regardless of whether they had a chance of long-term success. The government today emphasizes policies such as the following:

- Encouraging companies to focus on one or two businesses where they have a chance for international domination;
- Concentrating the nation's efforts in a particular business sector on one large company, such as in telecommunications where three companies have been merged into one giant firm;
- Increasing public R & D and training support;
- Reduction of subsidies not tied to productive investments and increased incentives for private investment in companies.

Throughout the 1970s and 1980s, the French have had access to a powerful agent for restructuring individual companies, an interministerial committee known as CIRI which was formed to assist failing firms. The role and orientation of CIRI has changed through the years as French industrial policy has changed, but its history provides an instructive example of a restructuring approach which emphasizes using government as a catalyst to revitalize individual companies.

The Creation and Functioning of CIRI

CIRI, an interministerial committee on industrial restructuring, was established with very broad powers and a small secretariat to administer it.[2] Initially, the committee was motivated primarily by political and social factors, but over time CIRI came to see its role in terms of restructuring French industry for competitiveness. Through the secretariat, all major actors in a failing firm—shareholders, trade unions, banks, and other creditors—were brought together with the government to develop a restructuring plan. The government was prepared to provide funds, but only if all other parties made an equal contribution. CIRI could also negotiate within the government for targeted social adjustment programs that would be tied to the industrial restructuring. At its peak, CIRI was committing 1.5 billion francs annually ($325 million Canadian) to the recovery plans it developed.

CIRI must be understood in context. The history of France is one in which the state rather than the private sector has often led the search for economic solutions. The French Minister of Finance, who chaired CIRI, had tremendous power to bring companies, banks, and unions together to negotiate. The strong role of the government in the finance industry further enhanced the convening power of CIRI. Until recently, the banking and venture capital industries in France were not sufficiently experienced in turnaround situations to put together restructuring deals and, in many cases, welcomed the government's involvement. There was also no group of ready entrepreneurs to take over failing companies and try to revive them.

The Workings Of CIRI

CIRI had three clear phases of development:

- *Phase 1—1974-79*

During its first five years CIASI (CIRI's forerunner) was negotiating about 60 company restructuring deals each year. CIASI was effective in financial restructurings, but placed little emphasis on industrial restructuring for competitiveness. Its focus was mostly on smaller firms in hard-hit regions.

- *Phase 2—1979-84*

During this period, a huge number of firms in many sectors got into difficulty. The focus of CIRI consequently shifted more to industrial restructuring for international competitiveness. However, CIRI still tried to save most firms, regardless of their competitive position. At its peak CIRI was concluding about 110 restructuring deals a year.

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[2] This section draws heavily on Canada Consulting and Telesis interviews in France, especially with Pascal Lang, former Director General of CIRI, and Elie Cohen, Chargé de Recherches CNRS.

- *Phase 3—1984-87*

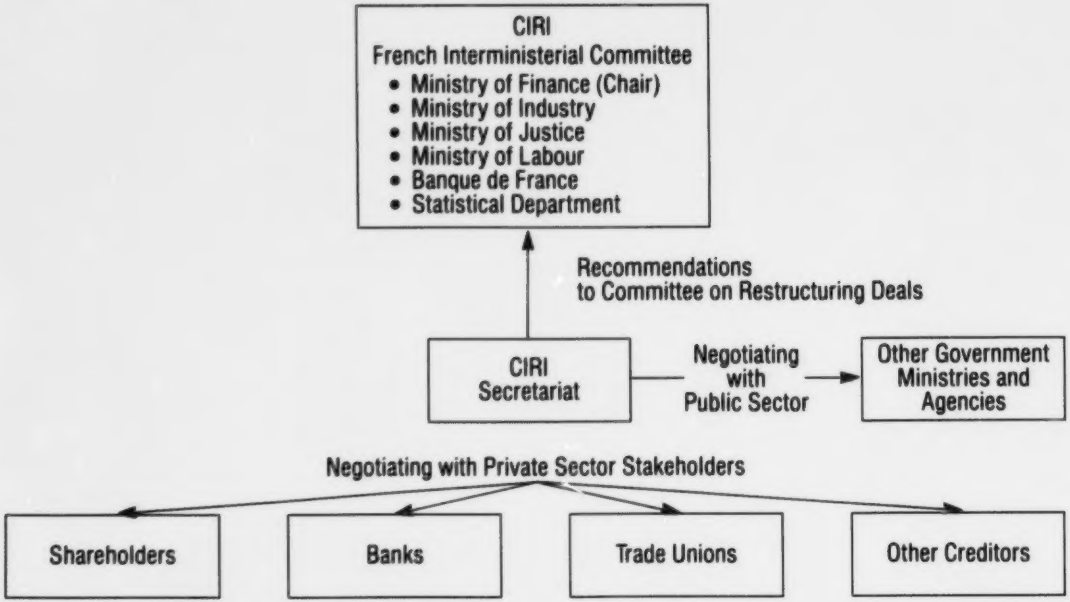
By this time, CIRI was negotiating 40 deals each year. CIRI was gradually being phased down, a signal of the improved economic climate in France and of the government's increasing willingness to let firms go bankrupt, exemplified most dramatically by the decision to allow Croiset Loire to fail. CIRI became more selective, focussing only on firms that had a significant chance of success after restructuring.

The CIRI secretariat was the focal point for all negotiations (see Exhibit II.6). It operated with a small, expert team of professionals; the secretariat consisted of only 20 professional people at its peak (1982-1984). Roughly 50 percent of its staff were selected from the civil service (most from the Ministry of Finance) and 50 percent were seconded from the private financial sector. In its heyday, CIRI functioned as an elite group, respected by both the private sector and other agencies of government. The staff was of exceptional calibre, and ex-CIRI people now occupy senior positions across the civil service and in industry.

CIRI was fundamentally a negotiating and deal-making agency. Typically, problem situations were referred to CIRI from the regional departments of France. Failing companies were dealt with individually; sector restructurings were not attempted as such. CIRI would quickly analyze three aspects of each case: the financial problem, the industrial problem, and the social problem. Each CIRI staff member handled five or six company cases at once, negotiating with all key parties—the firm's management, shareholders, trade unions (after 1981), banks, and other creditors. As needed, CIRI would recruit outside partners, especially potential buyers of the faltering company. CIRI could bring to the table many levers of government policy, including loans, subsidies, grants, and tax forgiveness or deferment, which could become part of the restructuring package. Negotiations were usually conducted in a crisis atmosphere, with CIRI at the centre putting together a mutually dependent package of concessions. At its peak of activity, the Interministerial Committee met once a week to review the final arrangements. With all key ministries represented, each case would be either approved or voted down. To prevent deals from unraveling, no modifications were allowed.

EXHIBIT II.6

CIRI OPERATING STRUCTURE


CIRI
French Interministerial Committee
• Ministry of Finance (Chair)
• Ministry of Industry
• Ministry of Justice
• Ministry of Labour
• Banque de France
• Statistical Department
Recommendations to Committee on Restructuring Deals
CIRI Secretariat
Negotiating with Public Sector
Other Government Ministries and Agencies
Negotiating with Private Sector Stakeholders
Shareholders
Banks
Trade Unions
Other Creditors

Source: Canada Consulting and Telesis, based on interviews in France.

CIRI's Success

CIRI's activities peaked in 1983 when 130 of the 140 firms referred to CIRI were assisted. About 110 of those cases eventually resulted in restructuring plans, with CIRI spending about 1.5 billion francs (Cdn. $325 million) on those cases. Total employment at the 110 firms was 100,000 before restructuring and 70,000 afterward.

CIRI was eventually wound down for several reasons. The economic recovery of recent years has significantly reduced the number of failing firms in France, and many of the sectors in which CIRI worked extensively have now been restructured. In the last 10 years, French banks developed their ability to handle restructurings. In addition, the French have become more accepting of bankruptcies, with a corresponding decline in support for state-assisted bailouts—however well conceived. Since CIRI began, there has also developed a proven group of French rentrepreneurs[3] and a venture capital community capable of doing restructurings.

A number of the companies CIRI restructured are thriving today:

- Textiles—Devenlay Textile Group was significantly restructured after all its banks refused to help. It subsequently became a stock market favourite.
- Tires—Dunlop Tire was sold to Sumitomo and was successfully restructured.
- Printing—Monsouret printing group was restructured with wage cuts and productivity concessions from the trade unions and financial concessions from shareholders and its banks.
- Motorcycles—CIRI assisted in selling NBK to Yamaha, which subsequently revived the firm.
- Machine Tools—Toyoda bought Ernouet Somua after CIRI took charge of its restructuring.

Politically, CIRI was extremely successful in managing difficult corporate dislocations. Hundreds of enterprises were restructured, many in circumstances where bankruptcy was the only alternative. Of these, many returned to a crisis state within a few years, but others went on to succeed. Even in the cases where a crisis recurred, CIRI often performed a much-needed social management role in easing the companies out of existence through several refinancings. CIRI was a very efficient operation using government assistance in a highly leveraged manner. But CIRI

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[3] The French term for entrepreneurs who specialize in company turnarounds and restructurings.

was not able to stave off the loss of major French competitive positions in machine tools, textiles, and other sectors. It did not really have a mandate to study or attempt to reverse the underlying competitive problems in French industry.

Some Lessons From The CIRI Experience

Several lessons can be drawn from the CIRI experience. A small, highly motivated team with strong authority and the ability to conduct good independent analysis can act as an effective restructuring agency. Most restructurings require a strong new partner—often a foreign company—to be successful. Government funds were less important than the ability of CIRI to negotiate with all the key players, both inside and outside government. However, CIRI's funding ability did help secure a seat at the restructuring table and certainly assisted in reaching some workable solutions. CIRI's ability to negotiate within the government and to formulate a social adjustment program concomitant with any major corporate restructuring enhanced its credibility with all groups and made plans involving major layoffs easier to negotiate. An agency like CIRI was best suited to working with individual firms and had much less success in restructuring an industry as a whole, where the actors were too many and the interests often too diverse.

RESTRUCTURING OF DECLINING INDUSTRIES IN JAPAN

A Focus on the Sector

Japan's success in structuring its economy to produce goods with competitive costs and superior quality is evident to purchasers of virtually any type of manufactured products during the past two decades. Less evident, perhaps, is the impressive ability Japan has developed since the late 1970s to manage declining industries.

A number of factors have forced Japanese political and economic decision makers to focus on how to restructure declining industries, even as their overall economic strength continued to grow. These factors included:

- the energy price increases of the late 1970s, which had a particularly debilitating effect on an economy that had become the world's most heavily energy-dependent, despite the almost total lack of indigenous energy resources;
- the emergence of newly industrializing Asian countries as significant competitive threats in industries that had been Japanese strengths;

- sharp increases in the value of the yen relative to the dollar, first in the 1970s and more dramatically in the past three years.

Government Involvement in Restructuring

In adjusting to new economic realities, Japan has emphasized programs to remove over-capacity from the marketplace, to retrain and reassign workers, and to help troubled companies diversify into more promising sectors. In contrast with many western countries, Japan has had remarkable success in keeping the political response to failing industries linked with the responses of financial and industrial institutions. The result has often been orderly disinvestment, allowing realignment of resources without massive unemployment and, eventually, the retention of a strong position by the restructured industry in world markets. The role of government agencies and the elected Diet (parliament) has been central in developing and guiding restructuring programs, but private sector institutions play key roles in implementation.

The success of efforts to restructure declining industries in Japan can be understood in terms of the broader historical context within which Japanese industrial policies have been developed and applied. These are some of the important elements that have influenced Japan's development:

- Japan has a long tradition of government intervention in the manufacturing economy to set long-range goals and manage programs to reach them.
- Industry, government leaders, and the public expect economic and political institutions—public and private—to support one another.
- There is a pervasive cultural bias towards building consensus through detailed and often lengthy consultations among groups of all kinds, rather than a tradition of leadership by strong individuals in either government or private enterprise.
- Japanese government agencies attract a strong, professional bureaucracy that enjoys a degree of public support generally unknown in western democracies.
- While participation by industry in many government programs is generally voluntary, there are strong practical and cultural reasons for complying with agency guidance.
- Deep public support for restructuring of failing industries was readily developed because of the sudden and adverse affects of the energy crisis of the 1970s.

- Direct government aid may be part of industrial policy in Japan, but it is usually not as important a factor in success as other resources mustered from large and small business associations and financial institutions.

Policies to Aid Declining Industries

The depth of the problems besetting Japanese industry in the late 1970s is reflected in statistics. About 18,000 companies, or 1.3 percent of all Japanese corporations, went bankrupt in 1977 alone. The equivalent figure for the United States in that year was less than 0.4 percent. The liabilities of all Japanese corporate failures were more than $16 billion, compared to $3 billion in the much larger U.S. economy. At the same time, many sectors of Japanese industry, such as automobiles and electrical products, were achieving record profits.

Before planning policies to aid declining industries, Japanese policy-makers developed a criteria to determine which industries should be eligible for participation in any programs that were adopted. The well-regarded Nomura Research Institute cited important 10 criteria in determining the health of an industry. If an industry met most, but not necessarily all, of the following criteria it could be considered to be structurally depressed and in need of restructuring assistance:

- A large supply-demand gap for the industry;
- Strong competition in the markets for the industry's product;
- Slow expansion of industry markets;
- Very high production costs relative to overseas competitors' costs;
- A significant role for trading companies in the industry;
- Limited independence of the management (e.g., controlled by banks or receiving extensive government aid);
- The industry produces primarily intermediate goods;
- The industry does not produce a differentiated product;
- The industry is indispensable for national security reasons;
- The industry has not been able to raise product prices, despite large increases in raw material prices.

Nomura Research found that 12 Japanese industries, representing some 17 percent of total Japanese shipments in 1977, met enough of these criteria to be designated structurally depressed. The government acted early the next year by passing the Depressed Industries Law (DIL), which had been drafted by bureaucrats of the Ministry of International Trade and Industry (MITI).

The major thrust of the new law was to designate which industries were in serious enough decline to be candidates for restructuring, to allow the formation of cartels in these industries, and to permit members of the cartel and government to develop a joint stabilization plan for the industry.

The Restructuring Programs

The stabilization plans always called for a reduction in capacity among the cartel members and provided a combination of government and private assistance to subsidize the scrapping of capacity, often by guaranteeing any debt collateralized by the capital facilities targeted for scrapping.

The formation of cartels was regarded as a temporary measure and was allowed only in return for assurances that the industry would restructure itself by reducing capacity, thus providing for a planned downsizing rather than the indiscriminate collapse of firms. The scrapping plans removed the supply-demand gap and allowed remaining capacity to be operated profitably.

The authority to form cartels and subsidize capacity reduction was tied, through the stabilization plans, to efforts by the companies involved to retrain and relocate workers and to diversify their own businesses into more stable activities.

To be eligible for action under the DIL, industries had to meet four criteria:

- More than 50 percent of the industry's firms experiencing financial difficulties;
- Severe over-capacity in the industry, with no expectation of improvement;
- Firms representing two-thirds of the industry's capacity agreed to petition the government for designation as structurally depressed;
- General agreement within the industry that some scrapping of facilities was necessary.

When these four conditions were present in an industry, the law required MITI (or another agency, such as the Ministry of Transportation in the case of shipbuilding) to consult with industry advisory committees and formulate a joint stabilization plan. The plan forecasted supply and demand in the industry, determined the degree of excess capacity, and designated methods for reducing this capacity. The DIL required the Japan Fair Trade

Commission to approve all cartel formations and reduction plans. The actual capacity reduction plans were implemented by industrial cartels, with guidance from MITI.

To assist these plans, a special scrapping fund was created to guarantee the repayment of loans collateralized by equipment to be scrapped. The fund has a total limit of 100 billion yen and was initially capitalized at eight billion yen from the Japan Development Bank and 2 billion yen from the private sector.

It is important to realize that although the DIL authorized government action and set general guidelines for restructuring programs, a great deal of flexibility existed for MITI and the affected industries to develop implementation schemes suited to the particular difficulties of the affected industry. It is perhaps remarkable, in light of the debate over government intervention in the economy that permeates Canadian and U.S. society, that compliance with Japanese restructuring efforts is entirely voluntary on the part of both individual companies and industry groups.

It is also important to note that Japanese restructuring efforts are not generally aimed at propping up industries that have lost their overall competitive edge in the world marketplace. There are sectors where Japanese firms have had little chance to compete successfully, such as agriculture, tobacco products, and some alcoholic beverages. In these cases, there is no pretence of restructuring, and the Japanese adopt an unabashedly protectionist stance by restricting imports.

THE CANADIAN POLICY ENVIRONMENT

Canada's industrial policies and programs to assist labour adjustment and industrial restructuring have often been piecemeal and reactive—usually responding to a problem only after it has reached a critical stage. This has resulted in relatively short-term strategies, often lasting only a few years, combined with an emphasis on bailouts to salvage ailing companies. Although labour adjustment programs have traditionally concentrated on assisting workers to find new jobs rather than providing them with new skills for changing markets, training is now receiving more attention from governments.

Federal Adjustment Programs

At the federal level, industrial programs for labour adjustment are run primarily through the Industrial Adjustment Service (IAS). The Service, which was established in 1983 as Manpower Consultative Services, acts as a catalyst in developing strategies at the plant level to assist workers to adjust to layoffs or redeployment. The IAS can become involved in cases involving plant closure, threat of layoff, technological change, worker transfer, high labour turnover and, more recently, plant expansion. (see Exhibit II.7)

The IAS encourages management and labour to co-operate in easing labour adjustment to economic or technological change. To achieve this, it assists the two parties to form a bilateral committee to oversee the development of a strategy to deal with the problems involved (Exhibit II.8). The IAS also plays a consultative role in the adjustment process, particularly with respect to available labour market programs. However, its role is clearly restricted to being a facilitator. It is up to the parties themselves to devise the solutions.

The IAS has an annual budget of $10 million, $2 million of which is spent in Ontario. In 1986-87, 527 new agreements were signed involving 330,000 employees. Contributions by the Canada Employment and Immigration Commission amounted to $113 per worker.

The federal government also offers assistance for workers who wish to relocate in order to get a job. The Canadian Manpower Mobility Program helps workers who are unemployed, underemployed, or about to become unemployed look for work elsewhere. The program provided five types of assistance in 1985-86: exploratory assistance for workers to attend a specific job interview; relocation assistance; travel assistance for seasonal agricultural work; special travel assistance for a worker to obtain employment services; and travel assistance for temporary employment. During 1985-86, $8.9 million was used to help workers under the program; $2.4 million of this amount was spent in Ontario.

Training is another mechanism in the government's strategy to assist adjustment. Since 1984, all federal training programs have been subsumed within the six streams of the Canadian Jobs Strategy. Typically, people laid off from a job might use the direct purchase option for training, which is provided in a community college. For those affected by technological change or plant expansion, the Skill Investment or Skills Shortages programs are available. These programs defray the wages and training costs of participating employees—25 percent of total weekly wages if undertaken while on the job, and 60 percent off the job, to a maximum of $350 a week, plus reimbursement of training costs. In 1985, training benefits amounted to $235 million for these participants; the 88,900 unemployment insurance claimant trainees received average weekly benefits of $166 for participating.

EXHIBIT II.7

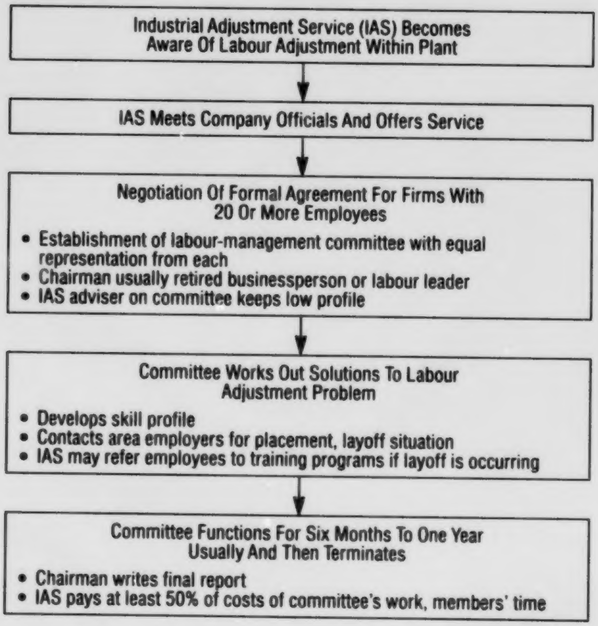
SELECTED ONTARIO EXAMPLES OF LABOUR MARKET ADJUSTMENT BY THE FEDERAL INDUSTRIAL ADJUSTMENT SERVICE

Company	Location	Year	Type of Adjustment	Description
Eplett Dairies	Timmins	1980	Human Resources	• Formation of a manpower adjustment committee to identify and develop a manpower training program was recommended through CEIC for 16 key positions.
B.F. Goodrich Canada Inc.	Midland	1979	Redundancy	• Formation of a manpower assessment agreement to assist 49 employees who were terminated to find other employment by canvassing other employers in the area. In 3 months, 37 had found employment, 3 were on retraining courses, and the rest were looking for employment. CEIC paid for half the cost of the program.
Photo Engravers and Electrotypers Ltd.	Rexdale	1979	Technological Change	• Formation of a manpower adjustment committee to develop program for 60 pressman and 35 paper handlers, involving reassignment of displaced employees, training on new equipment, and selection and training for initial start-up of new press.
Reichold Chemicals	North Bay	1974	Expansion	• Plant expansion involved an addition of 20 jobs and establishment of committee to arrange for training with assistance of CEIC; a modular training program was established.

Source: Industrial Adjustment Service, 1967.

EXHIBIT II.8

THE PROCESS OF FEDERAL GOVERNMENT LABOUR ADJUSTMENT ASSISTANCE IN CANADA



Industrial Adjustment Service (IAS) Becomes Aware Of Labour Adjustment Within Plant

IAS Meets Company Officials And Offers Service

Negotiation Of Formal Agreement For Firms With 20 Or More Employees

- Establishment of labour-management committee with equal representation from each
- Chairman usually retired businessperson or labour leader
- IAS adviser on committee keeps low profile

Committee Works Out Solutions To Labour Adjustment Problem

- Develops skill profile
- Contacts area employers for placement, layoff situation
- IAS may refer employees to training programs if layoff is occurring

Committee Functions For Six Months To One Year Usually And Then Terminates

- Chairman writes final report
- IAS pays at least 50% of costs of committee's work, members' time

Source: Canada Consulting Group, based on interviews with CEIC, 1987.

Some Historical Examples

The TAB Program: The federal government launched the Transitional Assistance Benefits Program (TAB) to assist Canadian auto workers adjust to the effects of the 1965 Canada-United States Automotive Trade Agreement. The immediate impetus for this program was a large rationalization project by Ford, which wanted to modernize its engine plant and temporarily lay off 1,500 workers.

TAB was established to provide laid-off workers with payments ranging from 62 percent to 75 percent of their weekly straight time pay, depending on the number of their dependents. Payments were not to exceed 65 percent of the average weekly salaries in the auto assembly and parts industries.

To be eligible for the benefits, unemployed workers had to

EXHIBIT II.9

PLANT CLOSURE REVIEW AND ADJUSTMENT CASES

Ontario
1986-87

Layoff Cases	
Full Closures	43
Partial Closures	12
Reduced Operations	43
Total	98
Employees Affected	
Full Closures	5,776
Partial Closures	889
Reduced Operations	5,629
Total	12,294
Employee Counselling Program	
Programs Established	23
Employees Participating	600

Source: Canada Consulting Group and Telesis interviews, 1987-88.

qualify for unemployment insurance and have worked for at least 30 weeks within the industry during the last year. This entitled them to four weeks of benefits with additional credits to a maximum of one year if they had two years of employment in the industry immediately prior to layoff.

The Adjustment Assistance Board was appointed to administer TAB in August 1965. However, by the time the new board began its task, the growth in employment in Canada's automotive industry had substantially reduced the need for adjustment assistance. By the time the program ended in 1971, only 3,100 workers out of a total of 8,600 who were eligible had received benefits totalling $3 million. Nevertheless, the program did provide autoworkers with a transitional safety net and encouraged acceptance of the Auto Pact among workers.

The Industrial Labour Adjustment Program: In 1980, the Minister of Finance announced a special allocation of $350 million for the Industrial Labour Adjustment Program (ILAP) to promote industrial restructuring, manpower retraining, and mobility in areas of particular need. The following year, four communities—among them Windsor, Ontario—were declared eligible. At that time, Windsor and the surrounding region, Essex County, were experiencing an unemployment rate of about 15 percent as a result of layoffs in the automotive and related industries.

The program had a number of components. For example, a portable wage subsidy entitled unemployed people aged 45 and over to a voucher that would enable a future employer to receive $2 per hour towards the employee's wages for 12 months. Another program component helped workers whose skills were in demand elsewhere relocate to those areas. Employees who moved permanently to a new community were eligible for three times the basic relocation assistance, to a maximum of $9,000.

However, ILAP contained several fundamental flaws that prevented it from assisting laid-off workers effectively. Response to the portable wage subsidy was limited, largely because workers who were re-employed by their previous employers could not use the voucher, and employers felt that the time and paperwork involved in making a claim were not worth the effort.

The relocation assistance was also poorly utilized. By the end of the first year of the program, only 18 relocation grants had been authorized. This was largely because of a 17 month time lag between the original announcement of Windsor's designation under the program and the eventual implementation of the plan. Many workers' unwillingness to relocate further hampered the assistance effort. Furthermore, another federal program, the Canada Manpower Mobility Program, already provided such assistance, thereby reducing the utility of the ILAP relocation initiative.

Two other components of ILAP, the Labour Adjustment Benefit and the Enhanced Training Allowances, also suffered from the delay in putting the program into action.

The Provincial Response to Adjustment

Ontario's Experience: The Employment Adjustment Branch of Ontario's Ministry of Labour represents the government's main vehicle for helping employees adjust to the effects of restructuring. The branch monitors large-scale cutbacks and closures, provides consultative assistance to employees and employers on the provisions of the Employment Standards legislation, and co-ordinates the involvement of other provincial agencies.

The primary function of the branch is to prepare people for the job placement activities of the Industrial Adjustment Service of the federal government. Its focus has shifted during the last 10 years from one of ensuring that employers provide severance pay to taking a more active counselling role. Employees affected by permanent job loss are given professional assistance in job search techniques, career assessment, access to training, and retirement and financial advice. The programs are delivered by staff at community colleges.

Several problems are evident in Ontario's approach to labour adjustment. First, the adjustment branch, like federal agencies, becomes involved only when a crisis has already arrived. Second, there is no co-ordinated government approach that links appropriate ministries together when such events occur. For example, in the case of two recent plant closures—Firestone and Richardson Vicks—efforts by the Ministry of Labour to obtain retraining money before the closures occurred met with little success. Ontario's Ministry of Skills Development matches eligible industrial training spending by employers. However, an employer shutting down a plant is hardly likely to have money available for training. Furthermore, most federal programs require that employees be laid off for up to six months before training funds become available.

Ontario has implemented significant changes to its *Employment Standards Act* in an effort to deal with labour adjustment in advance of layoffs actually occurring. Under the changed provisions of the legislation:

- An employer who gives notice of termination of employment under subsection 40(2) of the Act must provide the Minister of Labour with advance notice.
- Severance pay is now payable to individuals who are laid off from a company whose payroll exceeds $42.5 million.
- The number of notice periods for layoffs has been increased. There used to be four notice periods of one, two, four, and eight weeks, depending on an employee's length of service. Now, intervening periods of three, five, six, and seven weeks have been added to accommodate people with different lengths of service.
- When more than 50 people are being laid off, the notification periods are eight weeks for up to 199 affected workers, 12 weeks for between 200 and 499 workers, and 16 weeks' notice for 500 or more workers.

The British Columbia Experience: British Columbia appointed a

Commissioner of Critical Industries in 1985 with a two-year mandate to help rejuvenate the province's hard-hit resource industries by restarting operations that had been shut down and maintaining employment where firms were in difficulty. The process was a voluntary one; the Commissioner gathered all parties involved and tried to achieve a compromise on ways to reduce costs in order to restore and maintain jobs. The Commissioner's budget was $1.1 million, but only $435,000 was spent, mostly on consultants and accountants.

The program did achieve some successes, however. The Commissioner oversaw the drafting of economic plans for 11 operations employing 2,600 people throughout British Columbia. Six of those plans were developed for forestry industry operations, four for mining operations, and one for primary steel industries. The Commissioner helped companies avoid closures by negotiating concessions from creditors, unions, governments, and Crown corporations. These concessions included such measures as debt restructuring, profit sharing, and reduced property taxes, wages, benefits, and electricity taxes.

One of the most successful restructuring projects was carried out at Lamford Forest Products. The company, formerly called Sooke Forest Products, was $60 million in debt and had been closed for several months. The restructuring effort involved action by a number of players:

- The Bank of British Columbia provided a $6 million working capital loan.
- The British Columbia Development Corporation provided a loan of $2 million for shareholders' equity to be repaid by assignment of employees' wages, and a $1 million line of credit.
- The International Woodworkers of America Credit Union loaned $500,000 to provide equity in the new company.
- The City of New Westminster sold the Lamford Mill and associated property and leases to the new company for $951,000. Payments were to be made over 5½ years with no interest for the first 18 months and seven percent interest thereafter.
- The employees took a 20 percent cut in pay in return for profit sharing.

As of 1987, plants in New Westminster and Sooke were producing $40 million worth of red cedar products a year, and the 260 employees saw the value of their stock in the company increase by 30 percent.

Corporate Bailouts

Corporate bailouts represent a last-resort at industrial restructuring effort that has been used all too frequently by both federal and provincial governments. A corporate bailout usually takes the form of an injection of new funds directly through a grant, low-interest or no-interest loan, or indirectly by making it easier for a firm to obtain financing from the capital market. Often bailouts occur in politically visible companies with a large employment base in mature industries that are economically important to small communities. Between 1975 and 1982, more than a dozen large firms were bailed out through federal government intervention, mainly in the form of loan guarantees.

The success record of government bailouts of corporations has been mixed at best. Of the major firms that received government assistance over this seven-year period,

- Five went into receivership: Canada Cycle, White Farm Equipment, Maislin, Consolidated Computer, and Clarke Irwin.
- Four were bought by other companies: De Havilland was sold to Boeing; Dome Petroleum was taken over by Amoco; Minaki Lodge was purchased by The Four Seasons Hotel Group; and Canadair was sold to Bombardier. In all of these cases the government took substantial write-offs on its investment before the sale could be completed (e.g., $1.5 billion on the development costs for Canadair's Challenger jet).
- Two others—Massey Ferguson and Whistler Lodge—are still functioning but face some difficulties. Massey subsequently hived off its ailing combines business, which later went into receivership, and renamed the rest of the company Varity.
- Several troubled firms appear to have been turned around: Chrysler, Cooperative Implements, Electrohome, and Atlantic Fisheries remain viable.

IMPLICATIONS FOR ONTARIO

In Ontario, the core industries are at varying stages of restructuring and adjustment. Some, such as automotive and basic chemicals, have made major investments. Others are not as far along in this process. Newsprint producers need to shift some production to specialty papers; food processors must invest to expand their facilities to bring them up to world scale; and steel producers must increase their basic product quality and move to specialty engineered and custom steels.

Many of these industries will need to reduce their cost positions through productivity improvements and move to greater product specialization and business segments where value-added per employee is higher. These necessary adjustments will be further accelerated by the Canada-U.S. Free Trade Agreement. The process of industrial restructuring will be critical to Ontario's future economic prosperity.

In its main report, *Competing in the New Global Economy*, the Council made a number of recommendations to assist the province in meeting the challenge of this restructuring. Among them was the recommendation that Ontario establish an Ontario Recapitalization Incentive Plan to attract investors to indigenous midsize exporting companies going to public equity markets to raise new capital. Such a program would allow investors in new equity issues from companies in traded sectors to receive a significant tax credit or deduction. The investments would be restricted to a government-approved registry of firms that met certain provincial criteria, such as a listing on the Toronto Stock Exchange, a maximum total equity capitalization, substantial exports, and a minimum number of employees in Ontario. This recommendation sought to address a primary constraint to restructuring: the problem of raising new capital for Ontario manufacturers.

The Council also recommended that Ontario establish a sound industrial restructuring process requiring the active involvement of business, labour, and government and aimed at achieving timely and workable restructuring actions. The process should focus on traded sectors and direct efforts towards viable restructuring arrangements, not bailouts. The processes in France and Japan can serve as models of how this might be achieved.

The Council supported an early warning assistance program through an Industrial Restructuring Commissioner, as has been implemented in British Columbia. Such a program would have a number of operational principles:

- The Commissioner would work with the objective of entering the process early, which would be preferable to last-minute involvement.
- Declining industries would be anticipated and criteria would be established for the identification process, as in Japan.
- The Commissioner would work from a sound basis of competitive analysis using a small team of business specialists, a process which worked well with CIRI in France.
- Involvement of government would be forthcoming only if the key stakeholders had reached agreement to co-operate in developing and implementing a restructuring plan.

Further examination of the labour adjustment issues associated with restructuring in Ontario's core industries was also recommended. A comprehensive approach to meeting the adjustment needs of workers in these industries was suggested. Sweden was identified as one model, but others in Europe and the Far East are also worth considering.

If Ontario embarks on a new restructuring program that assists only viable firms that encounter difficulties, the province must also be prepared to help the workers at non-viable companies to develop new skills and find alternative employment. The Council, as part of its next agenda, will examine the entire spectrum of human resource issues related to its proposed economic strategy, including labour adjustment.

To ensure that the restructuring effort is supported and facilitated by a well-informed labour movement, the Council initiated a Technology Adjustment and Research Program (TARP) to encourage and assist labour and management to carry out research into the effects of technological change on workers and the company and how restructuring affects worker adjustment, and training in an industry.

As a further means of addressing restructuring issues, the Council also recommended a full examination of the potential benefits of encouraging broader worker ownership in Ontario companies. The worker ownership option has been used very effectively in the case of the Quebec Solidarity Fund to provide troubled companies with a new source of capital, while at the same time offering workers an opportunity to assist in returning companies to viability.

CHAPTER III
SPURRING HIGH-GROWTH AND EMERGING INDUSTRIES

It is difficult to find a case in any country of a successful high-growth or emerging industry that has not benefited from a supportive government policy framework. Competition in most high-growth and emerging sectors is such that significant and very risky investments must be made very early in the life cycle of the industry. Governments everywhere have found that there is a need for them to support the early development of new technologies to ensure that they have an industry in that area in the future. There has also been a recognition that a healthy base of indigenous firms is required to exploit the economic potential of new technologies. For countries that lack a strong base of such companies, government can play a role in encouraging their development.

Ontario faces particularly difficult circumstances in its high-growth and emerging industries. The province has only two large and relatively strong high-growth sectors: telecommunications equipment and aerospace. It has missed major opportunities in computer hardware and risks missing equally significant opportunities in software, although a number of small firms are now competing vigorously in export markets. In some of the important emerging sectors of the future, such as biotechnology, Ontario firms have only a precarious toehold.

Compared to other industrialized countries, Ontario finds itself with a large trade deficit in these high-growth sectors and relatively lower value-added per employee than might be expected, given the province's wealth creating capacity in other industries. If nothing is done to improve the competitiveness of Ontario's high-growth sectors, the trade deficit in these areas will accelerate. Because these sectors represent the fastest growing part of the economy, such deterioration in trade will have a disproportionately negative effect on the province's overall trade balance.

Closer examination of the Ontario situation in high-growth industries reveals that the root of the problem is a lack of large, indigenous firms in these industries capable of competing against multinationals from other countries. Small firms operating entirely within a domestic market are not likely to succeed in the long run in most high-growth industries. Competition in these sectors is global, and new products must be introduced almost simultaneously in all markets. A firm that hopes to launch its product in Canada today, tackle the United States next year, and Europe or Japan the year after is probably already dead in the water.

Companies in most high-growth businesses need to grow to a size sufficient to reap economies of scale in marketing, distribution coverage, production, application engineering, and other areas. Moreover, in businesses where R & D costs are significant, scale is needed if companies are to amortize R & D costs competitively. Ontario cannot hope to be successful in most high-growth industries without developing a small cadre of strong, indigenous multinationals that can capture the competitive advantages of scale.

CHALLENGES AND LESSONS FOR ONTARIO AND CANADA

A review of other countries' successful industrial policies for high-growth and emerging sectors reveals several lessons that transcend the specific circumstances of any particular jurisdiction. The most important messages for Ontario in the successful experiences of other countries are as follows:

- Government must take the lead role in creating the science and technology infrastructure that can conceive and nourish new industries.
- Industry must take the lead role in directing the commercialization of new technologies and the development of markets for them.
- All policies must place early emphasis on the development of strong indigenous companies capable of competing in world markets; countries without such firms must be prepared to share the risks involved in developing them if capital markets are unable to do so.
- Government should avoid picking specific technological winners, except where it is a natural purchaser of the product, and then it must use procurement strategically to foster the growth of world-competitive indigenous suppliers.
- A process of setting national R & D priorities by industry-government consensus is critical to focus pre-competitive R & D efforts effectively.
- Small, flexible agencies staffed by highly motivated people with industrial experience are generally the best vehicles for delivering assistance.

The programs governments use to develop high-growth and emerging industries vary widely in focus, scope, and degree of effectiveness. Analysis of the most successful approaches indi-

EXHIBIT III.1

NON-TAX GOVERNMENT SUPPORT FOR INDUSTRIAL R & D AS A PERCENTAGE OF R & D PERFORMED IN INDUSTRY

Country	Non-Tax Support
United States	33%
United Kingdom	29%
France	22%
West Germany	18%
Canada	**12%**

Source: Canadian Manufacturers' Association, Discussion Paper, February 1986.

cates that there are essentially five types of mechanisms with a strong track record in various countries:

- R & D tax incentives and matching R & D grants;
- Risk-sharing funds for new product development and market expansion;
- Prototype end-user purchasing assistance for high technology products;
- Strategic procurement in government purchasing;
- Applied research consortia of industry, universities, and government.

This chapter looks at the effective use of R & D tax credits in Quebec and the innovative approach the United States has taken to funding R & D in small and medium-sized businesses. Sweden's Industrifonden is described as an outstanding example of the risk-sharing fund concept. The Japanese computer leasing program illustrates the power of programs to assist in the purchase of prototypes and the acceleration of product life cycles in the marketplace. Programs in Quebec and France illustrate the opportunities that can be derived from a strategic approach to government procurement. The effectiveness of applied research consortia is discussed in Chapter V of this volume.

R & D INCENTIVES IN QUEBEC AND THE U.S.

Throughout most of the industrialized world, R & D tax incentives are used widely as an efficient means of assisting high-growth industries in taking the risks associated with new product development. Economic studies in many countries have shown repeatedly that individual companies are limited in their ability to reap all the benefits of their own R & D investments. Thus, much of the economic benefit of industrial R & D necessarily accrues to society at large. This economic argument for public subsidies to corporate R & D can be paired with a competitive argument: since other countries give their companies incentives for R & D investments, governments must offer something that is at least comparable to what is available in other jurisdictions; otherwise, domestic firms will be at a competitive disadvantage.

Exhibit III.1 illustrates the overall weakness in Canadian government support for industrial R & D. The R & D tax credit mechanism in Canada is at least as generous as those found in most other countries. However, Canada lags severely behind other countries in direct grant and contract (non-tax) assistance to industrial R & D. As shown in Exhibit III.1, the competitive disadvantage that afflicts Canadian firms because of this R & D assistance gap is significant. All told, 33 percent of R & D performed in industry in the United States is funded by government non-tax assistance; in Canada it is only 12 percent.

Quebec R & D Tax Incentives

The government of Quebec, recognizing some of these realities, has adopted a special R & D tax regime that makes performing R & D in Quebec more attractive than in other provinces in Canada. Quebec provides a 20 percent refundable tax credit on the salaries of employees engaged in R & D and a 40 percent university R & D tax credit on the costs of performing industrial R & D on contract in universities. In addition, an individual can claim a 133 percent deduction from taxable provincial income for the cost of R & D performed by limited partnerships in universities. This deduction is increased to 166.6 percent when such expenditures are carried out under a university research contract.

Unlike Ontario, the Quebec government does not tax federal R & D tax credits, and it even offers a 24-month tax holiday on the personal income of high-calibre foreign researchers. These R & D tax incentives have cost the Quebec government an estimated $100 million annually.[1] Quebec also incurs additional costs through a number of loan and grant programs to assist R & D.

As Exhibit III.2 shows, available R & D tax incentives, both provincial and federal, are much more attractive in Quebec than

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[1] Quebec announced additional R & D tax incentives of 50 percent or 100 percent in its 1988 budget.

EXHIBIT III.2

AFTER-TAX VALUE OF R & D INVESTMENT TAX CREDITS— ONTARIO vs. QUEBEC

1987

	Ontario	Quebec
Qualifying R & D	100%	100%
Federal ITC @ 20%	20	20
Quebec ITC @ 20% of Direct R & D Costs*		11
Total ITCs	20	31
Less Federal Tax @ 30%	6	9
Ontario Tax @ 14%	3	–
Total Tax	9	9
Net After-Tax Value of R & D ITCs	11%	22%

* Direct R & D costs (salaries, wages) assumed to be 55% of total qualifying R & D.

Note: Assumes a company doing business only in Ontario or only n Quebec. For most companies, the determination of provincial tax is more complicated than the above example. in some cases, Ontario can generate tax revenue from the Quebec tax credit.

Source: Developed by The Canada Consulting Group and Telesis.

in Ontario. Comparable firms performing R & D in Quebec and Ontario in 1987 would likely have received 22¢ of every R & D dollar back in tax credits in Quebec, compared to 11¢ in Ontario. This tax advantage has made Quebec a very attractive location for firms performing R & D. Several R & D-intensive companies interviewed during the course of the Premier's Council research indicated that the differential in R & D incentives between Quebec and Ontario was large enough as of 1987 to lead them over time to shift more of their R & D to Quebec, despite certain advantages (e.g., human resource availability) they might receive by locating it in Ontario.[2]

Since this research was undertaken for the Council, both Ontario and Quebec have improved their incentives for R & D. Ontario announced an R & D Super Allowance in the April 1988 Budget that would provide an extra 25 percent deduction for large firms undertaking R & D and 35 percent for small firms. For qualifying incremental R & D expenditures, the Super Allowance will increase this deduction by 50 percent. The estimated value of this new allowance is $45 million annually.

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[2] In Volume I of its report, the Premier's Council recommended, and the province subsequently introduced in the April 1988 Budget, new incremental R & D tax incentives for the province.

Quebec introduced a variety of measures to encourage additional R & D in its 1988 Budget. The Quebec Stock Savings Plan was enhanced to allow investors an additional deduction for buying stock issues in which more than half the proceeds are intended for R & D. This measure is worth an extra 100 percent deduction for investors in small firms and 50 percent for those in larger ones. To take advantage of this, however, a firm must forego the refundable tax credit on expenses related to R & D.

Quebec also increased the tax credit that small and medium-sized firms can claim for wages paid for R & D to 40 percent from 20 percent. Pre-competitive research conducted by a consortium approved by the government entitles the firms involved to a 40 percent tax credit on all R & D expenses, not just wages. The 40 percent tax credit now also applies to expenses incurred for R & D performed in the universities on the request of a private firm through a "linkage agency," namely the Centre de Recherche Industrielle du Quebec.

The U.S. Approach to Small Business R & D

The United States uses both tax incentives and direct government grants and contracts to support industrial R & D. The U.S. tax incentives for R & D are not as lucrative as those available in Canada. In the United States, current R & D expenditures are tax deductible, while capital expenditures follow the regular depreciation schedules. There is also an incremental 20 percent tax credit on the increase in current expenditures over the average expenditures of the previous three years. This R & D tax credit is limited, however, to $25,000 plus 75 percent of the company's federal tax payable.

U.S. tax incentives for industrial R & D are not as beneficial as those in Canada, mainly because the U.S. tax credit applies only to incremental R & D expenditures, while the Canadian tax credit applies to all current R & D expenditures. The United States augments its R & D tax incentives, however, through an extensive R & D granting and contracting system, centred in the Department of Defense but operating in many other areas as well. As Exhibit III.1 illustrates, these direct R & D funding mechanisms support 33 percent of all U.S. industrial R & D, compared to only 12 percent of all Canadian industrial R & D that is supported by non-tax based governmental funding.

One of the most innovative and successful aspects of the U.S. R & D granting system is the special emphasis placed on small business through the *Small Business Innovation Development Act*. The Act was intended to direct a greater percentage of available funding to technology-driven small businesses, and it assists such businesses through two programs:

- The Small Business Innovation Research Program (SBIR);
- The Research and Development Goaling Program.

In addition, the U.S. Small Business Administration (SBA) created a third program to complement the previous two:

- The Commercialization Match Program (CMP).

SBIR is designed to stimulate technological innovation by requiring that large federal agencies set aside a portion of their R & D funding for small business. Eleven government agencies, all with extramural research and development budgets of $100 million or more, participate:

U.S. Department of Agriculture
U.S. Department of Commerce
U.S. Department of Defense
U.S. Department of Education
U.S. Department of Energy
U.S. Department of Health & Human Services
U.S. Department of Transportation
Environmental Protection Agency
National Aeronautics & Space Administration
National Science Foundation
Nuclear Regulatory Commission.

The purpose of SBIR is to boost the level of research and development in small business without increasing the federal budget. Implicit in SBIR is the assumption that more small business R & D will bring more innovative products, processes, and services to the market. Each participating agency must designate a percentage of its R & D contracting dollars for small businesses (businesses with 500 or fewer employees). The percentage designated is to increase each year, reaching a maximum of 1.25 percent in four years.

Awards to small businesses are granted in three phases:

Phase I: Awards of up to $50,000 are provided to evaluate the scientific or technical merit and feasibility of an idea.

The performance period is six months.

Phase II: Awards of up to $500,000 are provided to pursue the technological development of Phase I results. The performance period is two years.

Phase III: Phase III is for commercialization of the results of Phase II research using private or non-SBIR federal funding.

The second part of the *Small Business Innovation Development Act* requires agencies with a research and development budget in excess of $20 million for any fiscal year (beginning with 1983) to establish goals for awarding R & D funding agreements to small businesses. These goals cannot be less than an agency's achievement during the previous fiscal year. In addition to the agencies participating in SBIR, the following federal agencies participate in this goals program:

Department of Justice
Department of Housing & Urban Development
Agency for International Development
Smithsonian Institute
Tennessee Valley Authority
Veterans' Administration.

Each participating agency can determine categories of projects to be in its program, receive and evaluate proposals resulting from solicitations, select businesses to receive awards, and administer its own funding agreements. SBIR funding is provided through three mechanisms: grants, contracts, and co-operative agreements. In 1985, grants accounted for 40 percent, contracts for 40 percent, and agreements for 20 percent of funding.

The Small Business Administration is charged with publicizing the programs and reporting to Congress on agency compliance. A basic aim of the *Small Business Innovation Development Act* is to convert R & D results into commercial applications. In keeping with this aim, the SBA created the Commercialization Match Program in 1985 to link businesses that have received SBIR awards with potential sources of capital—in both venture capital firms and large corporations. CMP is an information clearinghouse featuring a database that lists SBIR companies and their programs. It also notes sources of capital that have asked to be listed. The database contains information on more than 3,200 SBIR projects and 520 sources of capital. By mid-1986, CMP had been used by 325 SBIR companies, 110 large corporations, and 60 venture capital companies.

According to the National Science Foundation, one of the eleven agencies participating in SBIR, the $18 million in SBIR funds they expended in the first four years of the program were matched by private sector follow-on funding of $149.5 million. This amounts to a leveraging factor of 8 to 1 of private sector to federal monies.

The Small Business Innovation Development programs have been extremely successful in enhancing the growth of small and medium-sized advanced technology firms in the United States. By forcing federal departments to encourage small business participation in their R & D efforts, the Act has also helped open up federal procurement opportunities to smaller firms—and has done so at an early stage when the specifications for products are still being developed. In this way the programs have often acted as an enabling R & D contract fund similar to what the Premier's Council proposed in Volume I (Recommendation 6).

Interestingly, the SBIR definition of a small business—firms with fewer than 500 employees—is far larger than what is considered a small business for purposes of Canadian industrial assistance programs. The Ontario Development Corporations, for example, treat businesses with fewer than 25 employees as small businesses. The larger U.S. definition reflects a recognition that, in global terms, even firms with a few hundred employees can still be small businesses.

SWEDEN'S PRODUCT RISK SHARING FUND

Often the most critical investments for companies in high-growth and emerging industries are not in fixed assets but in product development and marketing. For many small to medium-sized companies, even those that are successful in world markets, each new product development represents risks high enough to spell disaster should they fail. For some firms, the number of good new ideas they could and, from a competitive point of view, should develop is greater than the number they can afford to invest in. Other firms have found success in a specific market segment but do not feel up to tackling a related one. In these and similar cases, countries such as Sweden, France, and Japan offer special shared risk funding to encourage development. Their programs are usually based on some form of conditionally reimbursable loan, repayable only if the project succeeds and often at something closer to equity rates of return than the normal loan rates available from banks. Typically, these loans cover up to half the project risk and are awarded only after careful screening to test the product concepts with expert independent opinion.

EXHIBIT III.3

EXAMPLES OF PROJECTS CO-FINANCED BY SWEDEN'S INDUSTRIFONDEN

COMPANY	PROJECT	AMOUNT (Millions SEK)
SAAB	Turbo-charged engine	50.0
Volvo	Vehicle traction system	45.0
Alfastar	Sterile food storage system	25.0
Sandvik	Hard material development	21.0
Ferroson	Psycho-pharmaceutical drug	16.4
Perstorp	Continuous process for high-pressure laminate	13.7
LKB-Producter	High-performance liquid chromatography	9.5
Luxor	Carrier system for data transmission power grid	7.8

Source: Telesis interviews at Swedish Industrifonden, 1986.

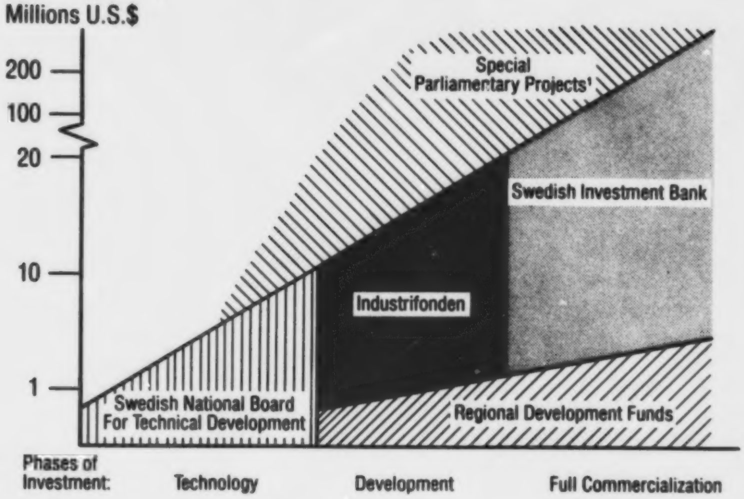
One of the most successful of these programs is Sweden's risk sharing loan fund, Industrifonden. Eight years after its inception in 1979, the loan fund was actually larger than the net government contributions to it. At the same time it has funded an impressive list of successful advanced technology projects that would not otherwise have been carried out (see Exhibit III.3).

The fund is viewed as filling an identified gap in Sweden's industrial policy framework. It takes up where R & D funding leaves off—at the stage of final product development and launch. The Swedish National Board for Technical Development provides R & D funds to companies, and the Swedish Investment Bank may provide long-term capital project financing to support fully commercialized products. Regional development funds can also provide development or investment support, but typically avoid high-risk technology projects. Thus, Industrifonden fills in the gap between R & D and normal long-term investments (See Exhibit III.4).

The fund was started in the late 1970s, when Swedish industry profitability was low and there was an acute need to accelerate the restructuring of industry towards higher value-added sec-

EXHIBIT III.4

SWEDEN'S POLICY FRAMEWORK FOR AIDING HIGH-GROWTH INDUSTRIES



1. Such as major aerospace developments.
Source: Telesis, adapted from Industrifonden materials, 1986.

tors. The Swedish government was spending a great deal to bail out companies in the shipbuilding, steel, iron ore, and paper sectors. The government was anxious to assist in industrial restructuring, particularly towards mechanical engineering, chemicals, and other growing sectors, but the traditionally strong Swedish firms in those industries were constrained from investing in many good ideas because of their own poor profitability and the high risk associated with new products. A devaluation of the Swedish currency helped improve profitability for these firms, and the Industrifonden helped overcome concerns about risk.

Industrifonden focussed on accelerating good technological ideas through their development phase. The fund has been making commitments of between $40 and $50 million (U.S.) a year for the last several years, a figure projected to rise to U.S. $70 million by 1989. Loans are set to yield above market rates if the project is successful. The fund is operating in the black, with interest income from successful loans covering a project failure rate of 15 to 20 percent. The fund would like the Swedish Treasury to contribute the equivalent of its losses each year (approximately U.S. $8 million to $10 million) so that overall capital can increase by that amount annually. Through 1986, total government contributions to Industrifonden capital stood at U.S. $133 million.

Industrifonden projects can be financed by one of four mechanisms: conditionally reimbursable loans, advances against royalties, risk insurance, or combined insurance and royalty (see Exhibit III.5). The fund's participation is always limited to 50 percent of any project's finances, up to a $7 million maximum fund contribution. This ensures that any firm bringing a project forward is putting a substantial amount of its own capital at risk.

Each project must be an inherently risky one that a company would not take on alone. In fact, some projects are rejected as too low-risk. Projects can include applied research, but must carry it through to an actual new product or process development. Each project must make sense from a business point of view; potential rewards must be proportionate to risk; and the applicant firm must be financially sound and have assured resources to meet its commitments. Preference is given to real innovation, as opposed to incremental improvements of existing products.

Most projects are initiated by company contact with Industrifonden. Application for funding is informal (no forms), and the process itself reveals much about the company's readiness to proceed (e.g., does it have a coherent business plan?). Industrifonden staff make an initial evaluation, rejecting one in four proposals at this stage. All remaining proposals are evaluated by independent experts. Sometimes the fund acts as a broker, suggesting that companies team up or seek out new partners. In the end only 25 percent of all project applications are approved.

Several factors are central to the success of Industrifonden:

- A well-defined mission to which staff and board have adhered closely;
- Tough professional review of all proposals, including technology and market feasibility;
- A loan rate set above market rates, thus encouraging industry to propose only projects that are truly risky;
- A high degree of selectivity applied to projects; the attitude is not to spend all the money available, but rather to find a way to help every worthwhile project;
- Informal participation with clients in the project, an active venture capital role rather than a passive government role allowing for exchange of ideas and improved project plans

EXHIBIT III.5

SWEDISH INDUSTRIFONDEN

Four Financing Mechanisms

MECHANISM	RATES	REPAYMENT TERMS
Conditionally Reimbursable Loans	2% above prime market rates—interest paid 4 times yearly	Interest due from beginning; principal repaid only to extent project succeeds
Project Advance Against Royalties	Royalties calculated to net 4% above Swedish prime market rate	Royalties start with initial sales but paid only to extent project succeeds; at certain point after cost recovery royalties drop to minimal level
Project Insurance For Failure	Company pays 2% premium annually on Industrifonden insurance level	Industrifonden pays its share of all net costs for failed projects
Combined Insurance And Royalty (New Product)	Insurance is 1.5% of guarantee and royalties are set to net 3% above Swedish prime rate	Combination of royalty and insurance terms

Source: Telesis interviews at Industrifonden.

- Regular review (up to four times a year) of project progress, with funding released only as needed;
- A professional fund administration staff drawn largely from industry.

In developing the idea of an Ontario Risk Sharing Fund to assist threshold companies in traded businesses (Recommendation 7), the Premier's Council drew on the Industrifonden model, but extended it to include risk sharing in the development of marketing offices outside North America, a critical need of Ontario firms, though not as pressing in the Swedish context.

THE JAPANESE COMPUTER LEASING PROGRAM

Japan has been very successful at identifying the most important points of competitive leverage in high-growth industries and applying government assistance there. They thus get far more effectiveness for generally less money. The Japanese computer leasing corporation is a case in point.

A major impediment to the development of Japan's computer companies was the small size of the Japanese market relative to the U.S. market. They could not hope to compete with IBM in the long run unless they could sell enough computers to obtain some of the advantages of scale that IBM had. The computer manufacturers and the Ministry of Industry and International Trade developed the idea of a leasing corporation owned by the manufacturers to accelerate the purchase of Japanese-made computers through subsidized interest rates for Japanese customers. The hope was that attractive financing would encourage users to move to new models before the old ones were obsolete.

The leasing corporation succeeded in accelerating purchases in Japan, but the corporation and its owners, the computer manufacturers, were suffering trade-in losses on old machines, even after these were sold outside Japan in the markets of less developed countries. In response, the government enacted favourable tax legislation that allowed Japanese manufacturers to reserve 20 percent of the original selling price against trade-in losses. IBM was not eligible for this tax benefit.

The leasing program, combined with additional special depreciation and tax benefits for purchasers, enabled the Japanese computer business to take off in the 1960s and 1970s through user-stimulated demand. Its greatest benefit was in accelerating the rate of new product development. The program allowed Japanese computer firms to develop prototypes of new models more quickly and to test them in the marketplace sooner than they would have under normal market conditions. The success of Japanese computer hardware firms was in turn a major boon to Japanese semiconductor manufacturers, who had a ready market for their more sophisticated products.

STRATEGIC PROCUREMENT IN QUEBEC

"Our company is a product of the buy-versus-build policy of the Quebec government." This comment made by a senior executive at one of Quebec's largest computer consulting firms captures the underlying principle of Quebec's approach to computer systems procurement: tender large-scale contracts to support local private sector firms instead of building internal government resources. To a large extent, this approach arises from the fact that the Quebec government sees itself as a partner in the growth of industry in the province. It has also come about, however, because of the unique circumstances under which public sector institutions in Quebec adopted computer technology.

Unlike other provinces in Canada, a significant portion of the hospital and school systems in Quebec were run by the Catholic Church until the 1960s. Meticulous records were kept by hand by a large staff of nuns and other clerical workers. When the government took over responsibility for many of these institutions, it was faced with the task of developing from scratch several large-scale computer systems. It was both a problem and an opportunity; while the cost of a mass computerization effort was enormous, Quebec did not have to deal with an installed base of obsolete equipment, problems of incompatibility between departments, and the organizational issues of trying to bring about change in an established system.

The Quebec government decided to procure the system development work from the private sector rather than design it internally. As one Quebec official from that era put it, "We recognized that we were not in the computer business and to get the best advice we had to go outside." Several Quebec government employees left to start their own companies and take advantage of these new procurement contracts. They received the full support of their former employer in doing so.

For the companies, it was not just the volume of work they got from the Quebec government, it was the kind of work that made the difference. Almost all the contracts were on a very large scale and had demanding technical requirements. This enabled Quebec systems companies such as DMR, LGS, and CGI to use the expertise they developed working for the provincial government to win contracts later in the Canadian private sector and in export markets. These Quebec companies occasionally make sales to the Ontario government. One Quebec systems company senior executive describes the difference between the two provinces by noting that: Ontario buys process. It buys tasks, per diems, and commodity products. This encourages small, independent firms but there is no incentive to build scale. Quebec buys solutions. They are buying results, not process.

It is no accident that the province of Quebec has at least three strong, exporting computer integration firms with sales in the $50 million range, while Toronto has none. Systemhouse, Ontario's largest systems integration firm, attributes its success to being located in Ottawa with access to federal contracts, not to provincial procurement. Quebec has achieved similar success in its strategic procurement of consulting engineering services through Hydro Quebec. These were described in Chapter XV of Volume II.

PROCUREMENT POLICIES IN FRANCE

The strong state-controlled procurement system in France also provides a useful contrast to federal and Ontario procurement policies. Under French procurement policies, government works closely with indigenous companies to develop world-class products and help them gain world scale.

In the 1960s, the French government identified six key areas in which state-controlled procurement could exert a major influence on industry: defence, telecommunications, nuclear energy, mass transport, offshore oil equipment, and space. In these industries, the French state was a primary or, in some sectors, the sole customer, technology developer, and industrial planner. For example, in the defence industry, a government commissioner sits on the boards of private contractors, directly supervises production of products, and underwrites most industry R & D.

In the French defence establishment, export market considerations are given great importance. There is an element of self-interest for the military because export sales can reduce their cost of procuring military equipment. Military products in France are designed with the needs and competitive dynamics of the international market in mind. Traditionally, French military products are configured to sell at a lower price than comparable U.S. equipment, thus appealing to countries that cannot afford U.S. military hardware. After products are commercialized, the French military takes an active role in export marketing and provides testing and training assistance to potential customers.

Government support has also been instrumental in making French corporations leading mass transport equipment suppliers around the world. The government has been involved in financing infrastructure, R & D, specifying systems, negotiating export contracts, and purchasing advanced technology systems. The recent extensions of the Paris subway and the high-speed rail link between Paris and Lyon were designed both to serve transport goals and to be showcases of French technology for export customers.

In telecommunications, the state is the only French customer for all French network equipment (switches, transmission, satellites). Most of the companies it buys from are also state-owned or controlled. As both customer and its own supplier, the government controls what R & D is done and strongly influences products and competitors, even in consumer markets such as answering machines and telefacsimile equipment. France has been quite successful in those telecommunications areas, such as teletext, where the state was able to fund advanced R & D and implement new systems on a wide scale.

In a fourth area of endeavour, the French government used its control of drilling leases off the coast of France and its influence in former colonies to encourage the development of the oil equipment industry. State-owned oil companies like Elf Aquitane also played a more direct role in procurement. The result was that, even though no substantial oil reserves were found in French coastal waters, France developed a world-competitive oil equipment industry, second only to that of the United States. French oil engineering companies like Schlumberger today operate as true global multinationals, serving the oil industry wherever it may be located.

Despite the successful use of procurement in several of these industries, French procurement is not without its problems. For example, product development to meet the needs of a single public sector customer sometimes does not result in products that can be sold in the private sector, or even in public sector markets abroad. Government purchases also tend to be large 'one-shot' contracts. Companies geared to meeting these requirements sometimes find themselves less than competitive in businesses where production line efficiencies are fundamental to success with private customers.

Because ranking government officials usually come from the same schools as the leaders of industry in their fields, it is not unusual for a government employee to move into senior management in industry and vice versa. This similarity of credentials and ranking between the public and private sectors fosters a climate of mutual respect and cooperation. However, it can sometimes be a drawback as well, leading to cozy complacency rather than focussing French industry on global markets and competition.

There is also an occasional tendency in French government procurement to let technical sophistication become all-important. Without the discipline of the marketplace and bottom-line accountability, procurement-supported companies may favour technological achievement at the expense of economically sound performance. France has found this in some defence areas, although by and large French defence equipment is cost-effective relative to U.S.-produced equipment.

Centralized government purchasing tends to encourage consolidation of firms within the country to meet large-scale requirements, but it often discourages international alliances and joint ventures. Even countries as large as France are finding their R & D budgets do not allow them to remain competitive with Japan and the United States in all fields of importance. European alliances are therefore becoming more and more desirable. The French government has become a leader in building European procurement-led technology initiatives like the Airbus aerospace consortium.

THE CANADIAN POLICY ENVIRONMENT

Canadian policies to assist high-growth and emerging industries fall into two basic categories: R & D tax and grant incentives and government procurement programs. There are no equivalents in Canada of the Swedish product risk sharing fund or the Japanese computer leasing program. While Canada's R & D tax incentives are at least as generous as those available elsewhere, the level of non-tax R & D assistance to industry in Canada is far behind that available in other major countries. Federal and Ontario procurement policies, with a few exceptions, have not been designed to achieve strategic objectives and have certainly not met with the success of Quebec or French procurement strategies.

R & D Tax Credits and Grants

Most direct government R & D assistance to high-growth and emerging industries is done at the federal level. The federal government offers several tax incentives to encourage industrial research and development in Canada, spending about $350 million in 1987. The tax measures include the deduction of capital expenditures on R & D, a partially refundable 20 percent tax credit for qualifying R & D expenditures of large firms, and a 32 percent tax credit on the first $2 million of expenditures by small firms. In the White Paper on Tax reform, the Minister of Finance proposed a limit on R & D tax credit claims in a single year to 50 percent of federal tax payable. He later indicated his intention to raise this to 75 percent of federal tax payable after the severe limitations of a 50 percent cutoff were recognized. These tax credits are in turn taxed by both the federal and provincial governments. In the case of Ontario, this results in a $35 million transfer from the federal government to the provincial treasury.

R & D tax credits benefit only profitable firms able to take advantage of the credit. A significant amount of industrial R & D in Canada is done by small firms, many of which are not yet profitable and cannot benefit from tax measures. For these firms, the National Research Council's Industrial Research Assistance Program (IRAP) is the primary assistance mechanism. IRAP provides grants to companies to carry out R & D on approved projects. Companies interviewed in the course of the Council's research strongly endorsed the IRAP program. Many commented on the flexibility of IRAP and on the professional and supportive manner in which applications were processed and approved. Approximately $15 million in IRAP grants is given to Ontario industry for R & D each year.

Both R & D tax credits and IRAP grants are limited with respect to the scope of qualifying projects. Final stages of product development and commercialization (including software development) rarely qualify. This gap is filled for some Ontario firms by Innovation Ontario, which provides venture capital financing of up to $250,000 to new technology-intensive businesses in the early stages of commercialization of their first product. In its first year (1986-87), Innovation Ontario funded 55 companies for just under $7 million. Medium-sized and larger technology-intensive firms in Ontario have no place to turn, however, for financial assistance with final-stage product development.

There is also very little financing available for testing and refining prototypes. For most firms, R & D grants and tax credits stop short of the prototype stage of product development, and there are no other financial assistance options available. Millions of dollars of research can be wasted if prototypes are not tested on real customers and appropriate refinements made before the product is launched. The Council's proposed risk sharing fund (described in Chapter VI, Volume I) was recommended to fill this gap.

Canadian Procurement Policies

For certain types of high technology products, another public sector lever can be brought to bear: government procurement. Both the federal and Ontario governments have procurement policies to support Canadian firms, but actual purchasing records show that these have been largely ineffective. A major reason is that current policies focus on establishing Canadian content levels in individual purchases, rather than establishing procurement policies to achieve long-term strategic objectives.

For example, Ontario's Canadian Preference Policy allows a price advantage to suppliers with significant Canadian content. A study of procurement decisions made in 1984 found that this policy made the difference in how a contract was awarded in only 20 contracts issued to the nearly 56,000 suppliers serving the Ontario government that year.

At the federal level, procurement policies are equally ineffective. Canadian content guidelines for computer hardware purchases, for example, are supposed to favour rationalized suppliers—companies that may be foreign-owned, but carry out manufacturing, R & D, or other significant value-added in Canada. However, 55 percent of all microcomputers purchased by the federal government in 1986 came from Olivetti—a company that simply imports computers into Canada—and less than one percent of purchases came from firms that are Canadian-owned.

In 1984, all levels of government in Canada (including agencies) purchased roughly $74 billion in goods and services. Of this amount, $24 billion was purchased federally, $32 billion provincially, and $18 billion by local governments, health care organizations, universities and schools. Eight percent of all these purchases was made from Canadian firms. However, only 50 percent of the value in these "Canadian" purchases was actually Canadian content. For example, a high proportion of software is purchased from Canadian distributors importing foreign software packages.

A detailed analysis of public sector purchasing in 1979 found that the highest levels of foreign content were in manufactured goods (as opposed to services) and, in particular, high technology products—the very categories most critical to Canada's future economic prosperity (see Exhibit III.6).

Current Federal Policies

Three federal procurement policies attempt to favour Canadian suppliers: the supplier classification system, the Canadian content premium, and the procurement review mechanism.

Supplier Classification groups suppliers into four categories based on the degree of Canadian activity conducted by each firm. Group one includes Canadian-based firms. Group two is comprised of Canadian-based agents of Canadian or foreign manufacturers that provide "suitable after-sales services", while group three covers those agents not offering such after-sales services. Group four companies are foreign-based manufacturers, service providers, agents, or government agencies. While the federal purchasing agency, the Department of Supply and Services, has no precise guidelines for use of these classifications, purchasers gen-

EXHIBIT III.6

LEVEL OF FOREIGN CONTENT IN CANADIAN PUBLIC SECTOR PURCHASING

Total Canadian Public Sector Purchasing (1979)	$ Billions	% of All Public Purchases	Estimated Foreign Content (%)
Services	$22	49%	24%
Manufacturing	19	43	49%
Primary	3	8	0%
Total	$44	100%	13%
High Technology Products	N/A	N/A	**57%**
Low Technology Products	N/A	N/A	34%

Source: Supply and Services Canada.

erally solicit offers only from companies in group one if there are a sufficient number of competing bids in that group. Purchasers give foreign-based firms in group four last priority when soliciting tenders.

The Canadian Content Premium (CCP) is a tool used to give preference to bids with higher Canadian content. A price premium of up to 10 percent is applied to bids with low Canadian content when they are competing with bids with higher Canadian content.

Usually, the Canadian content premium is very small, and seldom is it the deciding factor in awarding tenders. Not only is it of little advantage to indigenous firms; it does little to encourage foreign-owned multinationals to increase their Canadian value-added. With very few exceptions, it is not necessary for foreign companies to do more than sell in Canada to be eligible for government contracts. Furthermore, use of the CCP in major purchases is tightly constrained by the GATT agreement on procurement; on purchases valued at over $2 million, the CCP may not be applied except on purchases by the departments of Transport, Communications, and Fisheries, as well as for purchases of defence equipment and non-goods-related services.

Calculation of Canadian content in bids has also been changing. At one time it was restricted to manufacturing and R & D operations. Today this standard is being relaxed, with each company's situation considered on a case-by-case basis. Factors such as overall employment, plans for future investment, level of sales and Canadian exports, use of Canadian suppliers, and purchasing in Canada are also considered.

The third policy, the *Procurement Review Mechanism*, has also had limited success in ensuring and enhancing economic benefits for Canada. Procurement review committees made up of officials from Supply and Services and the user department(s), Industry, Science and Technology, Finance, and Employment and Immigration review acquisitions greater than $2 million in value or of any value where the socioeconomic impact is judged to be significant.

While most of these policies have been ineffectual, federal procurement policies have been successful in a few cases in enhancing the competitive position and long-term viability of Canadian suppliers. Defence offset agreements, for example, have been well used to encourage development of the aerospace sector and other defence areas. The CANDU nuclear energy program also resulted in some procurement-driven technology success stories like CAE Industries' nuclear plant simulators (see Chapter XIII, Volume II). On the whole, however, federal procurement efforts have not been adequately focussed on economic development objectives, with the result that little long-term industrial benefit has been derived for Canada from most of the major technology-oriented purchases made by Ottawa.

Current Ontario Policies

Ontario's procurement policies could also generate significant benefits for high-growth Ontario industries. However, a lengthy and time-consuming tendering process encourages government ministries to add internal resources rather than contract for services, and it discourages many companies from selling to the government in the first place. Those that do bid find that purchasing is highly decentralized, and most ministries prefer to break work into many small contracts rather than concentrate on a few large ones.

The combination of decentralized purchasing and low dollar value purchase orders makes the implementation of strategic development policies very difficult. Canadian content preference policies apply to all purchases over $15,000, but these almost never make the difference in how a contract is awarded. The irony is that even if the Canadian content premium made a difference, Ontario government purchasing orders are typically made in such small increments that the fortunes of Canadian firms are virtually unaffected by them.

The Ontario government spreads its approximately $1 billion in purchasing among 56,000 firms. This purchasing policy was designed originally to enable small and medium-sized enterprises throughout the province to have fair access to government procurement. However, the policy has had the negative effect of making it almost impossible for firms to build the scale capable of making them competitive in global markets. Today, 70 percent of all Ontario orders, accounting for 60 percent of total dollar value, go to companies with fewer than 100 employees. Of the 56,000 Ontario suppliers, almost 80 percent do less than $5,000 of business annually with the government. In fact, only 5 percent of Ontario contracts exceed $15,000. Far from being an effective strategy for promoting the development of Ontario firms, this policy has fragmented procurement to an extent that benefits almost no one. In fact, as in the computer systems integration industry, it has prevented the development of world-scale firms. A $1 billion customer that purposely buys from 56,000 separate suppliers encourages an industry structure of small enterprises.

The frustration of Ontario firms in dealing with this system while trying to build their domestic sales base is enormous. Since there is very little planning of government purchases, there is little opportunity for long-term nurturing of companies. A business in Ontario can seldom justify increasing R & D or manufacturing investments on the basis of its current, or guaranteed future sales to the Ontario government.

Two Ontario programs favour bids with higher Canadian content: the Canadian Preference Premium and the Industrial Development Review Process.

The *Canadian Preference Premium* is similar to the federal price premium program but works in reverse: ten percent for Canadian content is applied as a discount on the bidder's price. It applies to all purchases over $15,000. According to the procurement offices of the government, this program has mainly promotional value. It is supposed to convey an awareness of the importance of Canadian content—without ever making it so important that a company would consider the preference premium unfair.

The *Industrial Development Review Process* (IDRP) applies to all purchases over $250,000 (excluding services) and any other purchase identified as significant in terms of potential for industrial development. According to the guidelines for this program, the ministry making the purchase notifies the Ministry of Industry, Trade and Technology. If the purchase is deemed to be subject to IDRP, a Review Committee is formed. The committee carries out the tendering process and evaluates the industrial benefits of the bids. If a company other than the lowest responsible bidder is recommended, the tender is referred to Management Board for a final decision. In practice, however, few purchases are reviewed. On average, 30 purchases a year qualify for IDRP, and in perhaps three cases, a bidder other than the lowest cost bidder is awarded the contract.

Some of the most important provincial purchases, such as in health care, fall entirely outside these procurement policies. For example, routine hospital purchases are bought through two centralized Ontario purchasing groups in order to gain the price benefits of bulk buying. Most medical equipment is purchased at the discretion of individual hospitals. The vast majority of all health purchases, whether made through the buying groups or directly by hospitals, are from foreign suppliers with very low Canadian value-added. The Ontario market for medical devices is $600 million, a substantial customer for any health care supplier, but Ontario's decentralized approach to purchasing without any industrial development strategy has not harnessed this potential to persuade medical equipment companies to locate manufacturing or R & D facilities here. The Council addressed this untapped potential by recommending a health care procurement commissioner as part of its strategic procurement plan (see Chapter V, Volume I).

The Case of the ICON Computer

The ICON computer is one of the largest investments the Ontario government has made in high-growth industry development by means of procurement. A joint initiative of the Ministry of Education and the Ministry of Industry, Trade and Technology, the ICON was intended from the outset to create an indigenous educational computer hardware and software industry. However, five years after the original development contract was won by a consortium of small Ontario firms, the ICON has fallen far short of achieving its economic objectives.

There are many reasons for this, but perhaps the most compelling is that the government tried to lead the development of the technology rather than relying on the expertise of the private sector to design a product that would meet the government's needs and be marketable outside Ontario. The procurement contract for the hardware had unique and exacting specifications that none of the major computer vendors was willing to meet. Despite this signal that the government's design was unlikely to become an industry standard, the government made a substantial investment in what became a computer entirely incompatible with other models. The error of this decision was not offset by the fact that the government specifications correctly predicted the trends in educational computer technology that later developed. Even today, the ICON's 16-bit, networked hardware with high resolution graphics is considered the leading edge in educational computers. However, its market potential outside Ontario is extremely limited because neither the hardware nor the software is compatible with that of any other vendor.

The incompatibility problem was compounded by another strategic error—issuing many low-value software contracts to more than 75 small firms in the province. Because the contracts were small, none of these software firms could use them to gain sufficient size to attempt major sales outside Ontario. Today the manufacturing of the hardware has moved offshore completely in an attempt to bring the price of the ICON into line with other school computers. The ICON educational software "industry" is still made up of dozens of small firms employed by the Ministry of Education through a series of small contracts.

Meridian, the company responsible for manufacturing the hardware, has entered into a marketing and distribution agreement with Unisys, one of the world's largest hardware manufacturers. Their attempts to market the ICON in the United States have so far met with little success. Most computers used in U.S. schools are standard microcomputers, and the software is distributed by text book publishers and independent dealers. There are 10,000 software packages for the Apple computer alone. The ICON, being unique, depends on the custom Ontario software for its operation. Unisys has therefore had to enter into agreements with individual software writers to have any assurance it even has a complete product to sell. To date there are only 115 ICON software packages, many of which contain examples and references specific to school children in Ontario. Unisys is also finding that the U.S. market is not willing to pay a premium for the ICON's sophisticated features, so that ICON must compete directly with lower-cost models.

Recent events, however, indicate that there is still hope for the ICON computer to achieve some commercial success. A software interface is being written to make the hardware compatible with other microcomputers. The Ministry of Education specifications are being relaxed. The basis on which the Ministry purchases software may change to facilitate the growth of a few viable businesses, rather than 70 small cottage industry firms. This will require purchasing in scale and incentives to sell the product through royalties or fees, rather than only up-front funding to support the software writer's salary. The best hope may come from U.S. educational systems starting to consider custom software; they may call on the experience of the Ontario software firms. If this trend continues, Ontario educational software writers may yet realize the economic benefits of their investment in writing for the ICON computer. Although it is unlikely that the government will ever earn a satisfactory return on its substantial investment, the lessons learned in this experience may prove valuable for future procurement of new technology.

LESSONS ON PROCUREMENT FROM OTHER COUNTRIES

As this review of procurement policies in Canada and elsewhere has shown, several elements of a successful strategic approach to procurement are not present in either federal or Ontario purchasing policies. There are proven tools that other countries use routinely to maximize the effectiveness of procurement as an economic development lever. These include:

- Identifying procurement needs well in advance of tendering and providing long lead times on contracts for major purchases. (The ability to meet large volume requirements on short notice is clearly a competitive advantage of large firms, and in fields where Ontario has no large suppliers, long lead times can allow one or more small firms to emerge as competitive.)
- Contracting out R & D, specification writing, and other developmental projects ("enabling contracts") prior to tendering major purchase contracts can increase the likelihood that the most qualified bidder is a local firm.
- Creating special incentives in Canadian content calculations for local R & D activity or export targets. Today, non-traded elements of Canadian content, such as the employment of sales people in Canada, is weighted equally with factors like Canadian R & D and manufacturing for export.
- Consolidating contracts into larger purchases to foster the development of world-scale firms. In high technology sectors, particularly where the public sector is a major market, the structure of industry tends to reflect the purchasing patterns of government. In Ontario, where computer service tenders are usually small per diem contracts, there are no systems integration firms of any scale.
- Addressing the risks associated with selling new, untested Canadian products to government customers by setting aside portions of contracts for developmental products or offering prototype incentives within government for this purpose.

- Requiring government to meet targets for relying on strategically important outside services, such as systems integration and consulting engineering, instead of building large internal staffs for these purposes.

In its recommendation to establish a strategic procurement plan for the province (Recommendation 6), the Premier's Council has followed these precepts. In developing a strategic approach to procurement, Ontario must pay attention to identifying opportunities early, consolidating purchases to help suppliers achieve scale, using an enabling R & D contract fund to develop world-competitive suppliers, and having an independent Strategic Procurement Committee act as a counterbalance to the natural tendency of the supply and services bureaucracy to set a low priority on industrial development goals.

OTHER POLICY IMPLICATIONS FOR ONTARIO

The policies for high-growth and emerging industries examined in this chapter cover a great variety of points of competitive leverage in those industries. Mindful of the dual dilemma of Ontario in these high-growth sectors (poor international competitive position and lack of indigenous firms), the Premier's Council recommended that an Ontario Risk-Sharing Fund be established to share with Ontario's threshold companies the risks of new product development and overseas marketing. Such a fund would focus explicitly on the points of competitive leverage not targeted in current programs—that is, the full commercialization phase of product development and the creation of marketing offices and supporting infrastructure abroad.

The Council also recommended that the Ontario Development Corporations (ODCs) reorient their assistance efforts towards traded businesses, and especially high-growth industries. In addition, the Council encouraged the ODCs to move away from assistance related to fixed assets and to focus more on help with product development, prototypes, and overseas marketing.

Greatly increased R & D tax incentives, a Strategic Procurement Plan, an Ontario Risk-Sharing Fund, and reorientation of the ODCs add up to a highly targeted and leveraged program of assistance to high-growth and emerging industries. The linkages possible among these efforts are important, too. In the early stages of product development (and for large firms) the R & D tax incentives are most useful, but once products are ready for full development, the Risk-Sharing Fund and the ODCs should be able to assist indigenous firms of less than world scale to take the products forward. In areas where the Ontario government is a major purchaser, a strategic procurement plan can act as a major market pull mechanism, accelerating and focussing the product development activities of Ontario firms.

The most important lesson from the experience of other countries in developing high-growth industries is that government can have the greatest effect when its assistance aims to accelerate, encourage, share risks, or otherwise assist industry to follow market signals as industry sees them. The strategies of the Premier's Council for high-growth industries are based on just such a philosophy—leaving commercial decisions in the hands of business while working those points of competitive leverage where government can make a real difference in the success or failure of the enterprise.

CHAPTER IV

INSTRUMENTS TO PROMOTE ENTREPRENEURSHIP

Countries all over the world are recognizing the importance of a vibrant business and entrepreneurial culture. Not only is it the seedbed of future threshold companies and potential multinationals, it also accounts for a significant share of innovation in an economy. Governments have recognized the importance of this sector and have fashioned a wide array of policies and programs in an effort to help it thrive.

This chapter reviews the activities of governments in Quebec, the United States, West Germany and England in stimulating entrepreneurship, compares them with the programs in place in Canada and Ontario, and analyses the implications for future efforts by the province to foster this key force in the economy.

THE ENTREPRENEURIAL SPIRIT IN QUEBEC

In recent years, Quebec has experienced a dramatic upswing in business development and economic activity. The result has been the formation of a new business elite that has leapt to prominence largely as a result of government policies designed to encourage the growth of the productive sector of the economy. Quebec now has one of the fastest growing economies in Canada, a reflection of its burgeoning entrepreneurial spirit.

The policies that helped create this surge in entrepreneurial vitality arose from a conscious effort by Quebec governments in the 1960s and 1970s to enhance the province's economic position. These policies were designed to favour Quebec-based companies, foster a business ethic in Quebec, and encourage greater public investment in provincial firms. What follows is a brief discussion of some of the more significant government initiatives and how they helped stimulate this economic growth.

SDI: Quebec's Aggressive Business Development Agency

The Société de Développement Industriel du Québec (SDI) was established by the Quebec government in 1981 to promote economic development within the province by offering financial assistance to business. This assistance, consisting mainly of interest-free loans, loan guarantees, and shared-risk loans, is available to firms in manufacturing, tourism, and other targeted sectors. The priorities for investment are set by the province. SDI is not, strictly speaking, geared to the needs of new businesses, but it reflects the strong new Quebec commitment to entrepreneurship.

SDI, which is Quebec's equivalent of the Ontario Development Corporations, revamped its programs in 1987 to take account of the changing needs of its clients and the more vital entrepreneurial business climate. The new program uses a venture loan formula that is both appealing and accessible to high-risk businesses involved in strategic technologies or regional development. Program delivery has been streamlined to reduce bureaucracy, tighten turnaround times, and be more responsive to the business community.

The agency tracks loan activity and company performance closely to allow for early detection of problems. Even when problems do arise, the resulting political fallout is less intense than in other jurisdictions because such failures are regarded in Quebec as an acceptable and necessary risk in the venture capital business.

The overhaul of SDI has transformed the agency from a provider of grants to a lender. This change has been driven by the maturation of Quebec's small and medium-sized businesses, which no longer need or want grants to accelerate their growth. Under its new mandate, SDI will lend at market rates for up to 35 percent of the cost of research or export-related investments. The borrower receives a three-year moratorium on payments, but must repay the loan if the project is profitable. If there are no profits, SDI assumes the loss. Loans are collateral-free, but SDI retains the option to acquire shares in its client companies. If it is not possible for SDI to acquire equity, it may increase the interest rate on the loan by a couple of percentage points. It also charges an up-front administration fee of one percent of the loan.

As a result of these changes, SDI now spends considerably less to generate more income from its loan activities. In fact, unlike most public lending institutions, SDI's incoming funds exceed its cash outflows. The revamping of the program has also reduced the number of SDI's support programs to four, while cutting its annual case load from 1,600 to 400 companies (see Exhibit IV.1).

Since 1983-84, the total value of projects in which SDI has had a role has reached $3.4 billion. Its investment portfolio has also grown substantially since the early 1980s. The Export Assistance Program more than doubled its activity between 1984-85 and 1985-86, approving $70 million in assistance, compared with $33 million the previous year. This program offers a variety of types of assistance to companies, ranging from help for small and medium-sized firms to establish a presence in new markets, through financing exports with loan guarantees, to sharing the financial risk in setting up export consortia.

The Importance of The Canada-Quebec Subsidiary Agreement

The increase in SDI assistance to industry since 1983-84 is largely the result of a number of major projects set up through the 1985 Canada-Quebec sub-agreement on industrial development. This agreement, which involves the joint intervention of the federal and provincial governments in promoting major industrial projects, is a good example of how adept Quebec is at levering development assistance from the federal government.

Under the agreement, which runs until March 1990, a total of $350 million has been allocated to a program to assist industrial infrastructure ($50 million) and for investment in major industries ($300 million). So far, the agreement has been used to provide $170 million in financial assistance for six projects worth a total of $1.3 billion.

The agreement targets four priority sectors: information technology, biotechnology, manufacturing technology, and electronics. Its principal objectives are to stimulate research and technological innovation in Quebec firms, promote research that relates to industrial needs, encourage capital investment in innovating firms, and support cooperation between firms, universities, and other agencies on projects.

The Impact Of The QSSP

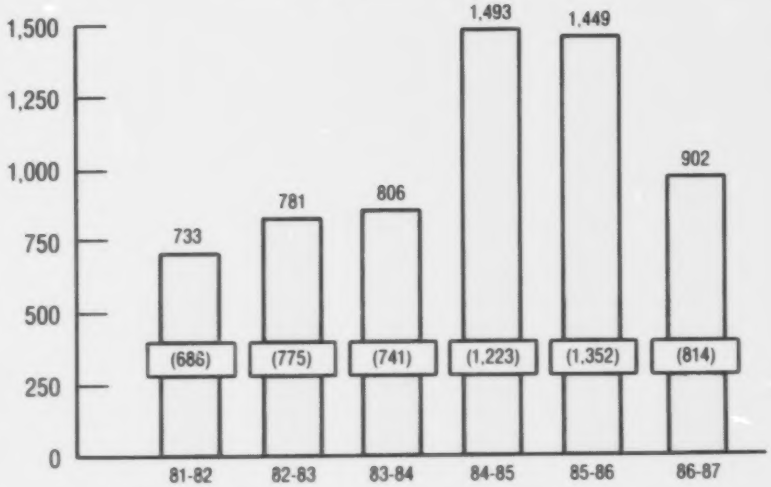
The Quebec Stock Savings Plan (QSSP), which was introduced by the Quebec government in June 1979, provides tax breaks to individual taxpayers investing in securities of eligible firms (See Exhibit IV.2). The plan was introduced to achieve three major objectives: reduce the tax burden of Quebec taxpayers; build an indigenous industrial capability in Quebec; and encourage the flow of capital to small to medium-sized firms in the province. Under the plan, Quebec residents are able to deduct the amount invested in newly-issued shares of corporations that have their head office or principal place of business in Quebec.

There have been modifications in the program since its inception. In the Budget of May 10, 1988, changes were made to tighten the system and focus the incentives more directly on companies needing public help and away from those that did not support major public policy objectives. In the early years of the plan, for example, there had been cases of funeral homes and barber shops

EXHIBIT IV.1

SDI'S CASELOAD
1981-86

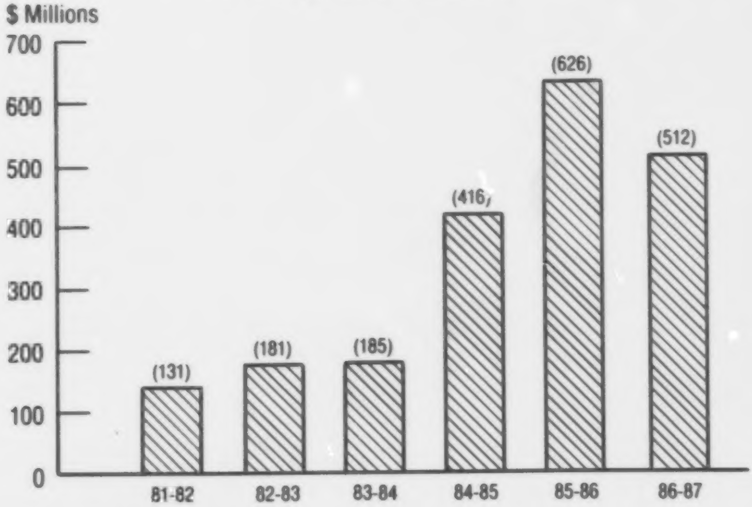
Number of Approved Applications



( ) Number of enterprises assisted

SDI

Value of Approved Applications



( ) Number of enterprises assisted
Source: Société de Développement Industriel, 1987

EXHIBIT IV.2

RATES OF DEDUCTION FOR QSSP ELIGIBLE SHARES

Category	1984	1985	1986	1987	1988
Major Companies (Assets over $1 billion)	75%	50%	50%	50%	50%
R & D*				100%	100%
Developing Companies (Assets between $2 million and $25 million or capital between $750,000 and $10 million)**					
Common Shares	150%	150%	100%	100%	100%
Restricted Voting Shares	100%	100%	75%	75/50%	50%
Preferred Shares Convertible into Common Shares	150%	150%	100%	100%	100%
Preferred Shares Convertible into Restricted Shares	100%	100%	75%	75/50%	75/50%
R & D*				200%	200%
Other Companies					
Common Shares	100%	100%	75%	75%	75%
Restricted Voting Shares	75%	75%	50%	50%	50%
R & D*				125%	125%

Notes: Allowable deductions are up to 10% of total revenue for the same year, the current limit being $1,000 for investments in major companies' securities.
* Firms using this incentive must renounce claims to the Quebec R & D Tax Credit Payable.

** The 1987 Quebec Budget doubled the upper limits of the asset or capital eligibility criteria to $50 million and $20 million respectively.

Source: Canada Consulting Group analysis of various public documents going public under QSSP. Large companies with blue chip stocks were also deriving benefits from the program, while small and medium-sized enterprises were not capitalizing on the plan as well as intended. Tax write-offs on investments in large companies were reduced to 50 percent. With the current rules, stocks acquired under the plan must be held for two years or be replaced by an equivalent amount of QSSP-eligible shares in order to maintain eligibility for deductions.

Participation in the program was impressive until 1985-86. Indeed, it has been cited as one of the driving forces behind the entrepreneurial revolution in Quebec. In 1986 alone, the value of investments made under the QSSP reached $1.76 billion, up from $1.27 billion in 1985 and $716.4 million in 1984. The total invested under the plan in eight years of operation reached more than $5 billion. During that time investors reduced their taxable income by close to $3 billion, resulting in some $784 million in lost revenue to the Quebec government.

Two out of every five Quebec residents in the $50,000-$100,000 income bracket and seven out of ten taxpayers with incomes over $100,000 participated in the plan in 1984. In 1985, 152,948, or 3.9 percent of Quebec taxpayers, benefited under the plan, claiming an average deduction of $4,275 on their income tax returns. By 1986, an estimated 185,000 taxpayers benefited under the plan.

The QSSP has had a significant effect on the provincial economy and on investment in the province. It has helped popularize share ownership among traditionally conservative Quebec investors. For example, between 1983 and 1986 the proportion of Quebec residents holding stock almost doubled to 14 percent (See Exhibit IV.3).

The QSSP has also stimulated investment in small and medium-sized businesses, providing them with the opportunity to finance expansion. These companies estimated that thousands of new jobs were created as a result of QSSP-related growth. By encouraging companies with head offices in Montreal to remain there, the stock savings plan inspired further corporate growth in Quebec and opened up new employment opportunities. The strengthening of activity in the financial services industry in Quebec can also be attributed to the QSSP.

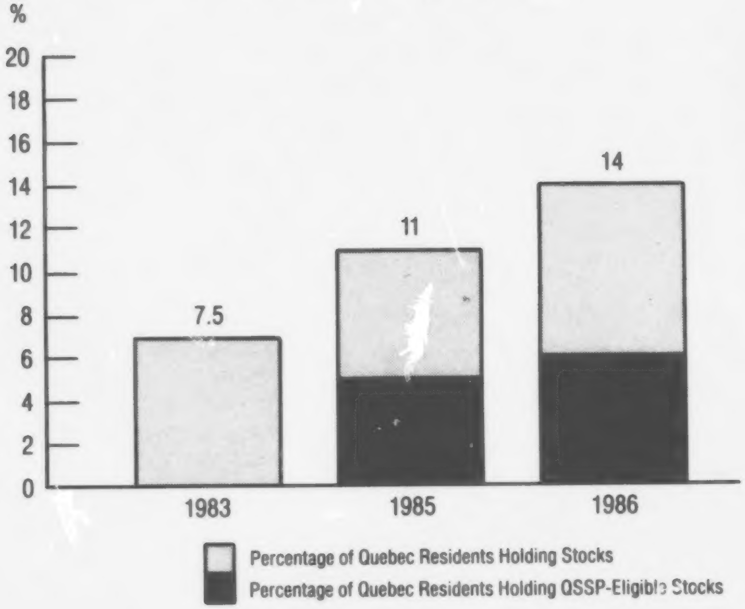
The Investment Focus Of Public Pension Funds

A final key to the Quebec entrepreneurial revolution has been the Caisse de Dépôt et Placement, which was established in 1965 to invest the contributions of Quebec residents to the Quebec Pen-

EXHIBIT IV.3

THE EFFECT OF QSSP ON EQUITY OWNERSHIP IN QUEBEC

% Of All Residents Owning Equity



Source: Commission des Valeurs Mobilières du Québec.

sion Plan, as well as various public sector insurance and pension funds. The Caisse, with assets of $25 billion and an equity portfolio of almost $8 billion, is the largest pension fund in Canada. It represents the fifth largest capital pool in North America.

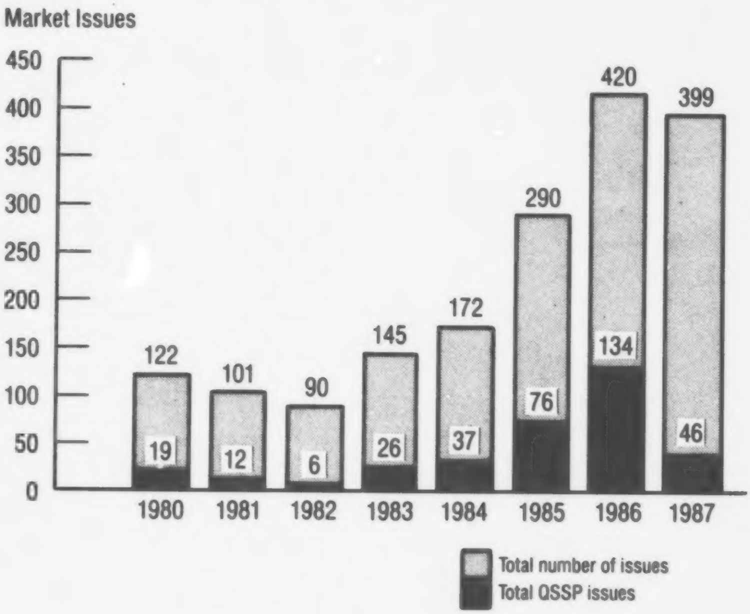
The mandate of the Caisse requires it to contribute to the economic development of the province while obtaining a reasonable rate of return on investment. By investing in Quebec-based corporations, contributing to the formation of new conglomerates, and channeling billions of dollars into the provincial economy, the Caisse has proved a powerful tool for stimulating entrepreneurship in Quebec.

The Caisse's investment portfolio is made up of three broad categories: fixed income securities, such as Government of Quebec bonds and mortgages (67.7 percent); variable income securities, such as shares, foreign securities and real estate (24.2 percent); and deposits and short-term investments (8.1 percent). Since 1980, there has been a gradual change in emphasis from fixed income securities to variable income securities. About

EXHIBIT IV.4

SHARE OF QSSP ISSUES IN THE TOTAL NUMBER OF ISSUES WITH PROSPECTUSES FROM 1980 TO 1985

Montreal Stock Exchange



30 percent of the market value of Caisse assets is in stocks, but the Caisse intends to increase this to 40 percent.

In 1986 the Caisse's 13.5 percent return on investment topped the median rates of return in every major pension fund category except equities. It also performed more strongly than other similar funds in the early 1980s. It invests heavily in small and medium-sized businesses and has earned a healthy 18 percent return in this area.

Unlike most pension funds, the Caisse invests more overseas than it does in the United States. Its U.S. investments accounted for 38 percent of its $1 billion international portfolio in 1986, compared with 36 percent in Europe and 26 percent in Asia. No more than 30 percent of the Caisse's portfolio may be invested outside Canada.

The Caisse has a strong fiduciary arrangement with its depositors, who provide policy direction on the investment of funds.

The Caisse meets each depositor four times a year, twice to review investment returns and twice to plan the mix of assets for the next 12 months. The depositors may make specific requests, such as asking that investments not be directed to certain areas for political reasons, but all final decisions rest with the board of the Caisse.

There are several key differences between the Caisse and private sector pension funds. Unlike private sector pensions funds, the Caisse has representation on the boards of companies in which it is a major shareholder. But it has moved away from taking substantial positions in major companies, selling some of its equity in Provigo Inc. and Noverco, for example.

In keeping with the way most public pension funds determine their asset mix, the Caisse buys more bonds than it would if decisions were made from a purely financial standpoint. The tendency to conservatism is understandable in view of the fact that the Caisse is more open to scrutiny than private sector funds. It publishes a list of its holdings every year, as well as providing detailed financial information in its annual report.

Despite its success in Quebec, analysts suggest this model may not be transferable to the rest of Canada. It has been pointed out that at least part of the Caisse's success is attributable to the unique social and political role it has played in boosting Quebec-based businesses. It would be more difficult in Toronto, for instance, to find the talented individuals willing to work in a public-spirited way for less than the investment industry pays, in part because Toronto represents a much more competitive market for financial professionals than Quebec City does.

PARTICIPATIVE VENTURE CAPITAL IN THE UNITED STATES

From California to Connecticut, 28 state governments have now initiated or sponsored venture capital corporations that provide the funding and sometimes the expertise necessary to start small businesses. Although risks are high, the success of programs in states such as Massachusetts, Michigan, and New York have caused a boom in state-initiated venture capital programs, especially in the Midwest.

Generally, state funding for venture capital corporations is provided by:

- selling bonds (usually the corporation has bonding authority);
- giving tax incentives to individual and corporate investors in the fund;

- allowing investment of public pension funds in the corporation;
- appropriations from general revenue.

In some cases, control over venture capital corporations remains with the state. But in the majority of cases, the state simply provides start-up money, leaving control, or at least majority control, in private hands. Below are a few examples of how funds are structured:

- **Public sector funds, capitalized with state or federal money, administered by a state agency:** California started the Innovation Development Loan Program in 1981 with $2 million from the Federal Economic Development Authority; the state added $500,000 in 1987. Florida, Illinois, Maryland, New Mexico, and Ohio also have public sector funds.
- **Public pensions monies are used to finance a venture capital corporation:** In 1985, $20 million in public pension funds were used to initiate the Kansas Investment Fund. Illinois, Michigan, New York, Ohio, Oregon, Pennsylvania, and Washington also have public pension funding of venture capital funds.
- **Tax credits:** In 1984 Louisiana initiated the Capital Companies Tax Credit, which granted a 35 percent tax credit for private investors investing in venture capital corporations. Arkansas, Massachusetts, Mississippi, Montana, North Dakota, West Virginia, and Kansas also use tax incentives.
- **Quasi-public funds—that is, an independent agency formed by an appointed state governing board from industry, academia, and government:** The Product Development Corporation, which began in Connecticut in 1975 with $17 million in state appropriations, was the first major quasi-public fund. Alaska, Arkansas, Iowa, Louisiana, New York, North Carolina, Oregon, Pennsylvania, Utah, Wisconsin, Wyoming, and West Virginia have quasi-public funds as well.
- **State-initiated private funds, which boost fund start-up while leaving decision-making authority in private hands:** State governments usually do not take an equity position directly because of state constitutional prohibitions. When they do take an equity position in these, it is a subordinate one. State governments usually do not take any role in decision-making except to establish general criteria. The Illinois Venture Fund-Frontenac Venture Company was established in 1984. Two million dollars was granted from appropriations, which was matched with $5 million from the Frontenac Company and $5 million from other

companies. Other states with such funds include Indiana, Iowa, Maine, New Mexico, and Wisconsin.

Some programs use a combination of the options outlined above. A number of major programs have been successful. There are, of course, many ways to measure success: number of jobs created, rate of repayment of loans and amount of money generated by the program among them. Massachusetts has created a number of programs that meet several of these criteria. For instance, in 1977 Massachusetts offered the life insurance industry tax relief in exchange for establishing a large venture capital fund. By 1986, this fund raised $140 million, which it invested in 100 companies, creating or retaining an estimated 8,200 jobs.

But not all programs have worked as well. An Alaskan venture capital fund, which was started with a state appropriation, raised $40 million to stimulate the renewable resource industry (i.e., lumber, fishing, and tourism). The program was eventually phased out. Its failure was reportedly the result primarily of catering to political interests.

Although state-sponsored or state-initiated venture capital programs have been successful in general, it is difficult to predict whether this will be the trend for most of the new programs. Most of the venture capital programs now in existence (19 out of 28) were initiated after 1983. Since it can take five to ten years for an idea funded by venture capital to pass through product development and market testing to achieve success in the marketplace, the success of many of these state initiatives is still unknown.

THE EXPERIENCE IN BRITAIN

The experience of entrepreneurs in Britain underlines the need for linkages between narrowly targeted policies and programs specifically for start-up companies and the broader policy framework in which all businesses operate. Favourable incentives for both entrepreneurs and their investors helped launch a healthy new business community in England. However, neither large-scale industry nor government was willing to play the critical role of customer and/or champion of these firms as they tried to grow. As a result, many formed alliances with firms outside England or simply stagnated in size—resulting in either case in reduced economic contributions by these firms.

The most prominent example of a burgeoning entrepreneurial culture in England is the 'Cambridge phenomenon'. As one of the first regions to establish a community of thriving high technology start-up companies, Cambridge has been studied as a model by many other jurisdictions. Like Silicon Valley and Route 128, during the 1970s and early '80s, the area attracted economists and social scientists attempting to identify the elements of success that could be applied to other regions. Traditional determinants of success included access to the faculty, students, and facilities of a world-class research university; availability of start-up venture capital; and a source of industrial research funding.

In recent years, the Cambridge area has attracted renewed interest, this time not because of its success but because of its ultimate failure to create new large-scale technology-intensive businesses. Many of the companies that showed promise in the 1970s have since been bought out, failed, or have simply been unable to grow into world-scale firms. By 1984, 75 percent of the Cambridge companies still had fewer than 30 employees.[1]

Research on the problems of Cambridge high-tech firms has concluded that it is not just the attributes of the region that create the conditions to foster entrepreneurial success, but the political and business environment of the country as a whole. Beyond a certain size of revenue, any business must look for opportunities in non-local domestic and export markets. In the case of high technology businesses, substantial national support is all the more critical. Once a firm reaches a 'threshold' size, the primary government support role often should be that of customer—or at least provider of incentives to large domestic businesses to buy from local high technology firms. The overall cultural, political, and economic climate must thus reinforce the value of entrepreneurial technology firms to the economic health of the country. This support never materialized for the Cambridge firms.

The Cambridge phenomenon began in the late 1960s, and the region quickly gained a reputation for world-class research and exciting new businesses. Many of the businesses were started by Cambridge University faculty and graduates. The environment was also highly desirable for professionals from outside the region, being close enough to London and a major airport, but based in the prestigious Cambridge University campus. From the beginning, venture capitalists, motivated in part by tax incentives, were attracted to the area, with the result that few credible new businesses lacked development capital. The British government, through its defence procurement and R & D programs, provided extensive support for advanced technologies. Substantial public sector investment was made in a new Computer Aided Design Centre.

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[1] Ann Lee Sacenien, *The Cheshire Cat's Grin: Innovation, Regional Development and the Cambridge Case*, Massachusetts Institute of Technology, 1987.

Technology-based businesses continued to form at a rate of about thirty per year well into the 1980s. However, many of the successful start-ups of the 1970s were selling out to foreign firms. Those that kept their independence had difficulty growing beyond 30 employees. Close to half the firms still had sales of less than £350,000. Overall, the region had created fewer than 6,000 new jobs over the last decade. The anticipated technology-driven economic boom had just not happened.

It is hard to find reasons within the Cambridge region for this relative stagnation. It still had all the attributes of an ideal setting for successful high technology firms. However, it seems to have been the wider economic and political environment of the U.K. that stunted growth in the region.

In part because of the decline in many of Britain's manufacturing sectors, new high technology firms have been largely unsuccessful in developing major domestic customers. Mature industries, such as steel, machine tools, and shipbuilding, are still lagging behind their global competitors in process and product innovation. Even sectors that rely on technology products, such as the automotive and instrumentation industries, have been slow to invest in technological change. The Ministry of Defence is a source of strong demand for high technology products, but the majority of defence spending goes to large, well-established firms. A 1984 review found that more than 60 percent of all defence contracts went to only 10 companies. The U.K. government had been supportive of the merger of several smaller electronics firms to gain the scale necessary to meet the country's defence procurement requirements, but in exchange gave them a protected market for their products.

As a result of the general state of British industry, many Cambridge firms had to look to export markets for their products at an early stage in the product life cycle. This added considerably to the risks of a small firm for a number of reasons. First, the final stages of a successful new product or new generation of an existing product are often developed in conjunction with a customer. This type of relationship is very difficult for a small firm to develop in an export market, as is the level of familiarity with the market needed to launch a new product. Lacking the resources and relationships necessary to sell independently in other countries, many Cambridge firms formed relationships with distributors. Without contact with the end users of their products, however, over time the firms became increasingly dependent on their distributors. It is not surprising that in some cases the distribution relationship led to the Cambridge company being bought out by the distributor.

The ready availability of early-stage venture capital obscured a broader problem for these entrepreneurs. Many of the investors were in the business only for the tax advantages of the investment. Consequently, they supplied the firm with early-stage financing, but lacked the expertise, contacts, and guidance to support the growth of the business. The Director of Corporate Finance at Barclay's Bank claimed that, of the 120 venture capitalists financing high technology start-up companies in the U.K., only six truly knew the business they were investing in. Thus, the Cambridge firms received the necessary capital, but lacked the wider assistance available from a participative investor.

The educational and technological infrastructure of Britain also worked against the success of the Cambridge firms. Engineering as a subject was introduced relatively late in the British curriculum and still lacks the status of more traditional subjects. Management programs are designed to prepare students to join the large, established institutions and corporations of Britain, not to start a business of their own. The most common complaint of Cambridge entrepreneurs is the lack of personnel qualified in international marketing. An education and training system geared to traditional skills and reinforcing existing institutions is unlikely to change quickly to suit the requirements of firms needing well-trained engineers and scientists with the entrepreneurial spirit and skill to create a successful new enterprise.

The Cambridge experience provides many valuable lessons for Ontario. It is not enough simply to support the early stages of new businesses. The broader economic and political climate must allow Ontario industry to thrive, especially in the critical 'threshold' stage. Isolated pockets of support for new technology-intensive businesses do not constitute a worthwhile investment of government funds if the wider environment in which these new businesses must compete works against them.

Few entrepreneurial high technology businesses in any region reach the world-class scale of a Hewlett Packard or a Sun Micro Systems. Nevertheless, policies must be geared to fostering that level of entrepreneurial success, not to creating an economy of perpetually small businesses, all competing for their share of government incentives and small contracts within a limited domestic market.

THE WEST GERMAN APPROACH

In recent years, the policies and programs of the Federal Republic of Germany have increasingly recognized the role of small business. Unlike Canada, however, German programs tend to draw a clear distinction between traded and domestic new businesses and between technology-driven, high-growth companies and small but mature manufacturing businesses. Most assistance is available only to firms with internationally traded products or services. A stated purpose of the assistance is to encourage the creation of more technology-based businesses.

Among seven government programs open to West Germany's small businesses (see Exhibit IV.5), two have been particularly successful. These are the equity capital loan program and the consulting assistance program.

The equity capital loan program was established several years ago to encourage the creation of more start-up companies by reducing the entrepreneur's financial risk. The financing is called an 'equity capital loan' because under the liberal repayment terms, the loan behaves more like equity than debt. In the first four years, little or no interest is charged. After that period, market rates of interest are fixed, then the principal is due at the end of ten years. If necessary, a further ten-year loan can be arranged.

Equity loans are made for up to 28 percent of the company's initial start-up investment (not including working capital). The entrepreneur must provide at least 12 percent of the capital, and the balance (60 percent) can be borrowed from a private bank, the government's ERP program, or one of the Lander (state) lending programs.

Thousands of new companies have now participated in this program, and the program's success in reducing the failure rate in the first years of new businesses has been dramatic. The overall failure rate for German start-ups is 50 percent; for start-ups in this program it is only ten percent. There are probably several factors accounting for this reduced failure rate. In the first place, the program allows access to low-cost capital in a manner that is not a burden to the company in its early years. Secondly, and probably equally important, the program requires that an independent consultant certify the viability of the business start-up. All equity capital loan applicants must have an independent consultant analyze their business proposal and conclude that it is viable. Government consulting assistance can subsidize up to 60 percent of the cost of such studies. If economic conditions worsen, West German officials predict that the failure rate will probably

EXHIBIT IV.5

MAJOR WEST GERMAN PROGRAMS FOR SMALL BUSINESS ASSISTANCE

Program	Approach	Funding Levels	
		1985 Actual (U.S. $ Millions)	1987 Projection (U.S. $ Millions)
R & D Personnel Subsidy for Small and Medium-Size Businesses	• Subsidy of up to 25% of total real payroll costs for R & D personnel	190	200
Consulting Assistance to Small Business	• Subsidy of up to 60% of consulting fees paid in first two years of any new traded business • Also direct assistance to Chamber of Commerce and handicraft (trades) consulting programs • Productivity consultants from RKW (Institute)	65	72

EXHIBIT IV.5 (continued)

MAJOR WEST GERMAN PROGRAMS FOR SMALL BUSINESS ASSISTANCE

Joint Industrial Research Programs	• More than 26,000 firms participate in joint R & D at common facilities or institutes	48	n/a
Low-Interest ERP Loans	• Loans made available at 2% below market rates to small businesses	42[1]	n/a
Equity Capital Loans for Start-ups	• Equity capital loans up to 28% of start-up investment; investor brings 12% and bank 60%	41	67
Support for German Chambers of Commerce Abroad	• Subsidies to Chambers of Commerce Abroad to help small businesses with identifying export and joint venture opportunities	15	17
Savings Plan for Small Business Start-ups	• Special savings plan for would-be entrepreneurs. Government will give grants worth up to 20% of entrepreneur's personal savings after 3 years for purposes of starting a new business	(New)	15[2]

1. Interest rate subsidy only; Telesis estimate
2. Estimate for 1990. In 1987, the program was only 2 years old

Source: Telesis and Canada Consulting Group interviews at BMW, 1987 increase somewhat, but it will be substantially better than failure rates of companies not in the program.

CANADIAN AND ONTARIO ASSISTANCE PROGRAMS

At the federal level, two programs are geared specifically to small business: the Federal Business Development Bank and the Small Business Loans Act.

The Federal Business Development Bank targets the small business sector (including, of course, new businesses) in both its lending and its venture capital activities. It is one of the largest sources of venture capital for small firms in Canada. However, notwithstanding its emphasis on this sector, the FBDB does not characterize itself as a participative investor and has little involvement in nurturing and developing its client firms beyond providing the traditional financial due diligence. As a lender, the FBDB concentrates on fixed asset financing rather than operating or business development loans.

The Small Business Loans Act is another federal mechanism geared to small (including start-up) businesses. Under this program the government guarantees 85 percent of the value of loans made by chartered banks to business with revenues of less than $2 million. Again, the emphasis is almost entirely on fixed asset financing. Most of the companies supported under this program are small service businesses operating only in the domestic market.

Like the federal programs, Ontario programs have a bias towards fixed asset financing and do not distinguish between traded and non-traded businesses. Because most new businesses are non-traded service companies, this type of firm receives the vast majority of the financial assistance available. Two Ontario programs that have targetted small business and are oriented towards manufacturing and/or high-growth companies are the Small Business Development Corporations (SBDC) program and Innovation Ontario.

Small Business Development Corporations are a vehicle to encourage investment in specific sectors of the economy by providing a tax incentive to the investor. The program has been successful in attracting incremental investment capital into small, usually mature manufacturing firms in the province. However, the 'small' criterion for companies discourages investment in high-growth firms that are projected to exceed the size criterion within the investment period and are likely to require capital beyond the scope of the program. Program stipulations also preclude participation by serious venture and capital investors who require the flexibility to make whatever investment decisions they consider appropriate without having to consider government guidelines.

Innovation Ontario Corporation supports firms that combine entrepreneurship and technological innovation. It provides seed capital up to a maximum of $250,000 to high technology start-up companies. It is designed to help firms with prototype development, business plans, market studies, and product development to get them to the stage where they will be able to attract private sector venture capital investment.

THE IMPLICATIONS FOR ONTARIO

Policies and programs for entrepreneurs in other jurisdictions offer valuable lessons for Ontario. For example, in Quebec a conscious effort by the government to improve that province's economic position led to several substantial and broadly-based assistance programs. The Quebec Stock Savings Plan was designed to stimulate investment in smaller Quebec firms going into the public equity market. It was dramatically successful but, being too widely applicable, subsidized numerous non-traded domestic companies with no business need to go public. Although Quebec's programs, taken as a whole, have been successful in stimulating entrepreneurship and industrial growth, the failure to target the points of maximum economic leverage has led to considerable spending by the government to achieve those results.

The U.S. states provide useful examples of direct government funding of venture capital. Although these programs have produced tangible results in a few states, in other states tax incentives to privately financed venture capital firms have generally proved more successful and at a lower cost to government.

In the U.K., small business assistance programs and early-stage venture capital incentives provided a stimulus to regions such as Cambridge. However, as these businesses attempted to grow, they encountered other government policies and practices that worked against their ultimate success. The lesson from the U.K. experience is to pay attention to the linkages between start-up assistance programs and the broader political and industrial environment which influences the growth and success of new firms.

In West Germany, governments at all levels have begun to assist entrepreneurs. In most German industrial policies, emphasis is given to supporting businesses in traded sectors. One of the most interesting aspects of the West German federal start-up assistance programs is the linkage between good consulting advice and the financial help offered. The requirement to seek independent expert advice seems greatly to improve the success rate of new businesses.

One of the most important findings from the Ontario research was that 90 percent of all new companies are non-traded businesses serving only local and/or domestic markets. The thousands of new businesses started every year in the province simply cannot be considered equal in terms of their potential to contribute to economic development and wealth creation objectives. The need to be selective in providing assistance is reinforced by the high failure rate among start-up companies. At least 40 percent of all businesses started fail within the first five years.

Another important conclusion of the Council arose from an analysis of the origins of Ontario entrepreneurs. Out of 184 entrepreneurs surveyed, only 10 percent came from the Canadian branches of foreign-owned multinational enterprises. (For a complete summary of the results of the start-up company survey, see Volume II.) The majority of entrepreneurs came from fully integrated indigenous businesses where they were exposed to product development, marketing, sales, and other operations. A number of R & D-intensive new businesses were university spin-off companies started by former professors. Government, despite being the largest R & D performer in Canada, was the previous employer of the entrepreneur in only one of the surveyed companies.

Again, these findings carry important policy implications. First, the rate of formation of start-up companies in Ontario is probably constrained by the high proportion of foreign-owned branch plants in the province. Policies that promote the success of indigenous companies (companies that behave like Canadian-owned firms regardless of their actual ownership) indirectly foster new business creation. While supporting new businesses can be viewed as investing in potential threshold companies, the inverse is also true: investing in Ontario's threshold companies supports future new businesses. Secondly, the concentration of R & D spending in government rather than in industry probably further reduces new business creation.

The overwhelming problem facing entrepreneurs in Ontario is a shortage of equity capital. Three-quarters of the companies surveyed on behalf of the Council cited lack of equity as a constraint to their growth. In Volume I, the Council noted that, although the venture capital pool as a whole was growing, the proportion directed to new businesses was actually declining. The Council's policy recommendations for entrepreneurs were developed primarily to meet this need.

The Council recommended that, rather than attempt to fill the gap in venture capital through direct government involvement, incentives should be introduced to stimulate private sector investment in early-stage companies. This could take the form of tax exemptions for investments in a special class of early-stage venture capital funds. Businesses qualifying for investment by these funds would include manufacturing or export-oriented service businesses committed to achieving substantial foreign sales over the next five years. In addition to redirecting funds to early-stage companies, the program would increase private sector expertise in working with these firms. Ontario lacks knowledgeable, early-stage financiers who understand the delicate art of nurturing young companies. Experience in the United States has shown that venture capitalists who take a participative role in early-stage investments are able to earn a far more satisfactory return; moreover, a higher percentage of the firms they back succeed. The more successful U.S. state venture capital funds have tried to attract such participative venture capital management.

Another major problem for young Ontario companies—and their investors—is the difficulty they experience in going public. This is a crucial step in their development because it permits wider investor participation, as well as the most advantageous exit route for early-stage investors. Without some assurance that a company will eventually be able to go public, venture capitalists are reluctant to invest. To encourage the development of an initial public offering market on the Toronto Stock Exchange, the Council recommended tax incentives to investors in initial public offerings of qualifying Ontario companies in traded sectors. Unlike the QSSP in Quebec, this would be a tightly-focussed incentive and not very costly to the government.

Another financing gap for entrepreneurs in Ontario is meeting the costs of new product development. Like most countries, Canada has R & D financial assistance programs as well as R & D tax credits. However, these apply only within a relatively narrow definition of R & D. Final stages of development, as well as later steps in the commercialization process, such as developing prototypes and market testing, do not qualify. For most small businesses, even those with a technologically-based product, carrying out pure research in-house is simply not feasible, especially subsequent to the scientific work that led to the company's first product. The Strategic Procurement Plan recommended by the Council offered one way to attack this problem for companies that have appropriate products.

All of the Council's recommendations must be seen as an integrated strategy to foster entrepreneurship in traded sectors. As the British experience demonstrates, venture capital incentives implemented in isolation from other policies supporting the growth and development of high technology firms into threshold companies will not be very effective. The proposed Risk Sharing Fund and the Strategic Procurement Plan are therefore just as much a part of the entrepreneurship strategy as the venture capital or initial public offering incentives.

CHAPTER V
SUPPORTING PRE-COMPETITIVE RESEARCH

Today's innovation-based economies require two key capabilities to be competitive. One is a solid foundation for basic or pre-competitive research—that is, research aimed principally at discovery rather than product development. The second is a public policy and business environment that helps transfer this scientific knowledge into industrial and commercial applications.

The basic research community is the cradle for new technology development. Companies which have access to the fledgling innovations in the pre-competitive stage can then develop and harness them for the marketplace. Yet the more critical science and technology have become to industrial productivity and profitability, the more difficult it has become for individual companies, whether large or small, to create by themselves the knowledge and technology bases each requires to capitalize on innovation.

There is a deepening dependence on R&D alliances, as opposed to company self-investment, as businesses discover the benefits of shared resources and technology. An increasing number of companies simply can no longer justify the expense and missed opportunities of developing a strictly in-house capability for longer term research.

There is, furthermore, a growing dependence on producer-supplier R&D alliances. Not only are large companies becoming increasingly dependent on basic research activities performed in government and university labs, but they have become vitally dependent on the technological sophistication of other companies, usually smaller, that dominate the ranks of their parts suppliers and vendor chains. Although large firms have the clearest access to R&D, either by performing it internally or by sponsoring it externally, many new products come from smaller companies.

The greatest benefits result when multiple sources of innovation can leverage one another. Ideally, large and small firms in the same production chain should be able to gain greater access to one another's technology bases and innovative capacities. Similarly, ways need to be found to create alliances among university and industry research activities that accelerate their respective R&D agendas.

Unfortunately, the relationship between R&D investment and economic outcomes is complicated in Canada by the often misunderstood motives and missions of the major players in the innovation process. As the first volume of the Premier's Council report pointed out, one of the factors underlying Canada's generally poor performance in research and development by various international standards is a basic confusion about what steps should be taken—and by whom—to improve competitive performance. The appropriate roles for government, universities and industry in the innovation chain need to be better defined and managed.

Challenges for Ontario and Canada

The experience of other countries in enhancing industrial R&D guided the Council's analysis of how Canada should approach the task of building an effective scientific capability to support industrial development. Ontario's and Canada's international competitors have recognized the importance of well-focussed financial and policy support for pre-competitive research as a basis for achieving industrial innovation and growth. Therein lies a critical challenge for Ontario and Canada: to build strength in basic and pre-competitive research as a means of promoting science-based innovation in industry. Nearly every country in the developed world has recognized that the connection between pre-competitive research and competitive industry-based development is vital to enhanced economic growth.

Other countries' success in making and capitalizing on this connection often results from their governments' taking a major role in supporting science and technology, both at the pre-competitive and clearly competitive stages. However, as described in Volumes I and II of the Council's report, Canada's public sector support for science and technology is well below that of other nations in both areas. Direct government funding for R&D has been traditionally weak in Canada compared to other countries. Indirect funding, primarily through tax incentives, has been comparatively strong in terms of competitive research carried out by industry. Yet tax incentives have not been very useful to R&D consortia, which have gained increasing importance as an efficient means of pooling the pre-competitive research effort and reducing the costs involved.

Canada's major international competitors have long recognized that R&D consortia represent a major vehicle for advancing innovation at the pre-competitive stage and have supported such consortia with appropriate public policy. They have also managed to sort out the role confusion that plagues Canadian R&D policy by recognizing—as Canada must—that government must provide leadership in ensuring that the pre-competitive R&D carried out in government and university labs is strategically directed without becoming a substitute for the applied research that industry is uniquely capable of performing. As well as defining the distinct roles that are appropriate to the private and public sector players, government must also provide policies that facilitate the movement from basic to applied research. And it is in this regard that R&D consortia can provide government with the leadership tool to stimulate the interaction that allows for technology transfer.

What follows is an examination of some relevant policy approaches in Japan, the United States, France, the United Kingdom, West Germany and Sweden. These countries vary in the motivations underlying their overall science and technology policies, the types of support they offer for basic, pre-competitive research, and the institutions and systems through which they lend support. The experience of other countries is then reviewed against Canada's approach and its appropriateness (given Canada's size, history, and industrial base) in order to gauge realistically what lessons might be learned from our global competitors.[1]

The United States, France and the United Kingdom

The motivation for science and technology policy in these three major military powers has been called 'mission-oriented'. Mission-oriented science and technology policies can best be described as 'big science for big problems'. Through large expenditures for military-related research and development, the governments of these countries have provided a great deal of indirect support for research in related technologies.

In the United States, the vast resources being invested in basic science and pre-competitive research are complemented by strong world-class research capabilities in private universities. However, because of the more limited resources available to France and the United Kingdom, their smaller industrial sectors (which are often not as attractive to the brightest scientists and technologists), and other socio-cultural and institutional constraints, mission-oriented support for basic scientific research in those countries has not produced such a successful record of industrial innovation.

Through grants and procurement—primarily military procurement—the United States government provides huge amounts of financial support for scientific research. In 1986, primary contract awards by the Department of Defense (those over $235,000) injected U.S. $19,811,808 into research, development, testing and evaluation, 86 percent of which went to business firms. Clearly, the support that private sector organizations get from this mission-directed basic research funding is not ideally suited for exploitation of commercial innovations, but because of the size of the commitment, and until recently the size of the U.S. GNP compared to that of competing countries, this support has resulted in significant prosperity for the United States.

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[1] The discussion which follows uses a typology for R&D performing countries developed by Henry Ergas in "Does Technology Policy Matter?" in *Technology and Global Industry*, National Academy Press, 1987.

Mission-directed science and technology policy does encourage a centralized system for establishing priorities and making decisions. This can be efficient in achieving given objectives, but the larger question for the United States is whether it can afford to continue to orient its science and technology efforts mainly towards achieving military goals. As the wealth of competing nations such as Japan approaches that of the United States, the United States must begin to consider a science and technology policy motivated by industrial innovation objectives that can be pursued without sacrificing its economic leadership.

In France and the United Kingdom, support for mission-oriented basic research has not been as successful in driving industrial innovation processes. In part, this is because of social and structural differences between the United States, France and the United Kingdom, but it is also largely attributable to the concentration of science expertise in private universities in the United States (which are better at transforming knowledge to the commercial sphere) and the fact that neither France nor the U.K. has an economy approaching the size of the U.S. economy. As long as it is the largest science and technology spender, a nation can at least appear to prosper without an industrially-oriented basic research motivation.

West Germany and Sweden

In contrast to the mission-oriented approach of the military powers, West German and Swedish science and technology policy has been called 'diffusion-oriented'. These countries seek to create a broadly-based capacity for adjusting to technological change throughout the industrial structure. This approach is found primarily in open economies where small and medium-size manufacturing enterprises are a key economic and political force and where the state aims to facilitate change rather than direct it. Three characteristics mark the economic and institutional framework required for successful industrial innovation in a diffusion-oriented science policy.

The most significant feature of diffusion-oriented policies is the depth and breadth of investment in human capital, centring on a dual system of education that includes a high-quality university system and an extensive system of vocational education. The second characteristic of the institutional framework is industrial standardization. The immediate impact of standardizing systems is to reduce transaction costs and to provide clearly specified interface requirements for products. The third characteristic, co-operative research and development, is a key domestic factor in countering the competitive imbalance posed by the smaller domestic economies and more limited resources of these countries.

Cooperation in research and development, both in setting strategic research priorities and funding pre-competitive research, are essential for smaller countries such as West Germany and Sweden, which have intricate institutional frameworks for setting priorities, gaining consensus, and concentrating resources in strategic competitive areas. In the case of the most successful countries, this priority setting is co-ordinated by government but given direction by industrial needs. As discussed later, West Germany and Sweden are also members of co-operative research efforts in the context of the European Communities. In competing on a world scale, the industrial, government and university sectors of smaller nations must co-operate if they are to match the research resources available to larger nations.

Japan's Successful Marriage

The Japanese framework for supporting research is both mission-oriented and diffusion-oriented. Through the successful marriage of these two approaches, the Japanese are aiming to be, and may already have shown themselves to be, the world's best managers of strategic, consensus-driven, pre-competitive research.

Economic indicators show that Japan has grown prosperous at a rate far surpassing that of any nation in history. Through an effective system of establishing priorities for strategic competitive objectives and concentrating research talent on top industrial priorities, Japan has set a standard for successful science and technology policy. However, Japan's unique history and geopolitical and economic position mean that this is not a model for every country. As we shall see, however, some of the basic principles adopted by Japan can be applied to the science and technology policies of any country wishing to encourage industrial innovation.

To understand Japan's success in aligning basic and pre-competitive research with industrial priorities, it is helpful to consider the country's unique history relative to that of western nations that went through the industrial revolution during the last century. As the Japanese economy has grown, the country has moved its economy from lower to higher value-added industries. As they have entered progressively higher value-added industries, Japanese science and technology requirements have also moved up the sophistication scale. Japan's industry was at first a technology imitator. As Japan began to compete in the higher value-added sectors, however, the need to build capabilities in developmental and applied research became apparent. More recently the Japanese have recognized their need to become scientific leaders if they are to remain at the economic forefront in the face of competition.

Because industrial competitiveness has been the traditional motivation for supporting basic and pre-competitive research, Japan's science base was built on industrial priorities. In this way, the Japanese have come to science from technology, whereas the West has concentrated on merging pre-competitive and basic science with industrially oriented technology. By linking its science base to applied research and industry, Japan can focus and concentrate its resources in relation to strategic goals.

To facilitate large-scale ventures into pre-competitive research fields, Japan has created several new basic research centres in the last few years. Because Japan is building its basic research base in order to enhance the effectiveness of applied research, these research laboratories have been concentrated, not in universities, but around industrial users of pre-competitive research. This serves to increase the ability of researchers to respond to priorities dictated by the international marketplace.

The Agency of Industrial Science and Technology (AIST), a division of the Ministry of International Trade and Industry (MITI), is charged with developing priorities for research in Japan and organizing government, private industry, and academic resources behind those research goals. The Agency's basic policy seeks "to provide an environment where the vitality of the private sector can be maximized". It focusses on areas where such a high degree of financial and technical risk is involved that the private sector alone would find it difficult to carry out development programs.

The setting of research priorities in Japan is clearly industry-led. This is aided on a day-to-day basis by the fact that major research centres are located near major industries. On a longer-term basis, however, Japan builds consensus on goals and priorities through leadership provided from the very top levels of government and industry.

EXHIBIT V.1

JAPANESE NATIONAL RESEARCH AND DEVELOPMENT PROGRAMS

Project	Time Frame	Est. Cost (U.S. $ Millions)	Description
1. One-carbon-molecules chemical technology	1980-86	$66	Economical production of ethylene glycol, acetic acid, etc. from alternative carbon sources
2. Manganese module mining system	1981-89	$125	Development of hydraulic dredging system to recover minerals from ocean depths of 4,000–6,000 metres
3. High speed computer system	1981-89	$143	Development of system 100 to 1,000 times faster than conventional computers
4. Automated sewing system	1982-90	$65	Highly automated sewing technology; computer aided
5. Advanced robot technology	1983-90	$125	Robotic systems to support people working in dangerous environments
6. Observation system for earth resources satellite	1984-90	$144	Synthetic aperture radar, visible and infrared radiometers
7. New water treatment system	1985-90	$74	Use of concentrated bioreactor and separation membranes in drain systems for water reuse and recovery
8. Interoperable database system	1985-91	$94	Distributed data bases and multimedia technology to form an infrastructure for the information society
9. Advanced materials processing and machining systems	1986-92	N/A	High performance machine tools and processing technology

Source: Telesis based on MITI interviews in 1987

National research in Japan can currently be grouped into three categories:

- A national research and development program involving nine large-scale research and development projects involving numerous national laboratories and private companies (see Exhibit V.1)
- The development of new energy technologies to help ensure Japan's energy security
- Research and development in basic technologies for future industries.

Basic technology research areas include new materials, biotechnology and electronic devices. Over a dozen individual projects have been established under these three general categories, with steering councils designating roles for government research institutes, academia and private sector companies working jointly under the overall control of MITI. It is essential to point out, however, that while government provides the leadership in this process, projects are managed and priorities assigned primarily by industrial participants. This research effort is being aided by the establishment of the Japan Key Technology Centre, which will provide interest-free financing and make direct investments in R & D firms. Initial funding for the centre was about U.S. $100 million (see Exhibit V.2).

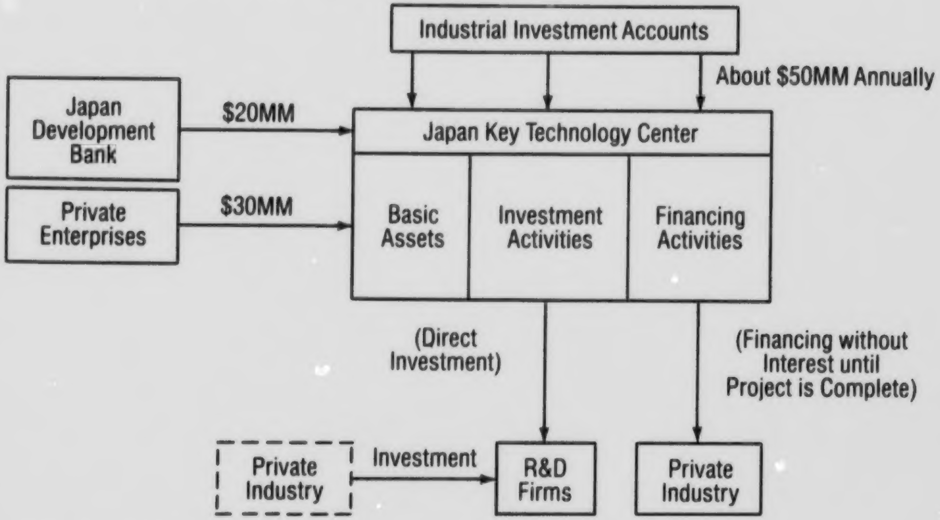
Research Consortia

Given the increasing complexity of science-based technology, an effective pre-competitive research program requires resources on a scale that is often beyond the capacity of many industries. This constraint applies even to major technology leaders such as IBM and Hewlett Packard. To deal with this problem, some corporations and several countries have formed industrial consortia to perform long-term, pre-competitive research.

Most high and medium technology sectors are increasingly characterized by rising research and development investment thresholds; below these thresholds, firms are unlikely to be successful at innovation. Yet effective development and exploitation of new technologies requires a broad spectrum of research and development capabilities. This problem is particularly acute for small countries where small and medium enterprises with limited research and development capabilities predominate. Pooling resources for generic research may have a considerable impact on how innovative these firms will be in the future. Several coun-

EXHIBIT V.2

JAPAN KEY TECHNOLOGY CENTER



Source: Telesis and Canada Consulting Group interviews at MITI, 1987.

tries and groups of countries have recognized the efficacy of the pooling approach through research consortiums.

The Japanese Approach with Fine Ceramics

Japan has pointed the way in terms of research consortiums involving governments and the private sector. Fine ceramics is a product area in which Japan has created a shining example of government-private sector cooperation in pre-competitive research consortia. In 1984, Japan's Fine Ceramics Working Group released a report that forms the basis of the current policy on fine ceramics. The working group consisted of fifteen economists, university professors and industry representatives under the auspices of the Consumer Goods Industries Bureau of MITI. In addition to establishing a policy on fine ceramics, the government provides financial support for small and medium-sized companies and other organizations, such as the Japan Fine Ceramics Centre, and the Japan Fine Ceramics Association.

The Japan Fine Ceramics Association is an integral part of the institutional framework employed by Japan to further industrial innovation in fine ceramics. Established in 1982 in Tokyo, the Association was intended to lay a foundation for the fine ceramics industry through information exchange, technology improvement, diffusion of fine ceramics technology, and diversification of its applications. Membership includes 200 different firms and organizations, and board affiliates come from the universities and from corporations such as Toshiba, Kobee Steel, Nippon Steel, Hitachi, and Mitsubishi. Principal activities of the Association are preparation of publications, organization of seminars for members, research into trends in fine ceramics, standardization of test methods and international information exchange.

The Japan Fine Ceramics Centre was established in 1985 in Negoya with the objective of encouraging the development and use of fine ceramics and fostering the advancement of the fine ceramics industry. Its membership and affiliations span the same type of influential public and private sector organizations as the Fine Ceramics Association. More than half of the engineers and scientists working at the Fine Ceramics Centre are sponsored by private companies.

The most important lessons to be drawn from the experience of Japan with research consortiums are the importance of top level involvement from government and industry, consensus-building to set priorities on industrial aims, and concentrating resources on a limited number of strategically important projects managed by private sector partners.

The ALVEY Program

The ALVEY Program was announced by the government of the United Kingdom on April 23, 1983. ALVEY was a five-year program of pre-competitive, collaborative research into enabling technologies in the information technology area. It was sponsored by the Department of Trade and Industry, the Ministry of Defence, and the Science and Engineering Research Council (SERC) together with industry. Total government funding for the program was £200 million over the five-year period, with industry contributing a further £150 million. The objective of the program was to increase the competitiveness of the information technology industry in world markets by doubling the level of information technology research in the U.K. over the five-year period.

For the United Kingdom, the program was unique in several ways. First, the emphasis was on collaboration between companies, academic researchers and institutions on individual projects. Four enabling technologies were defined against which detailed objectives and detailed technical strategies were developed: Intelligent Knowledge Based Systems (IKBS), Software Engineering (SE), Very Large Scale Integration (VLSI) and Man Machine Interface (MMI).

While the program was successful, at least in comparison to previous efforts in science and technology policy, there were some problems. One of the greatest problems was that instead of committing new government resources to these projects, funds were reallocated from other science and technology programs. It was also recognized that research at the single country level could have been performed more effectively and efficiently through closer coordination with another European information technology research consortium project, ESPRIT.

The Esprit Project

The European Strategic Program for Research on Information Technology (ESPRIT) took shape when EEC Commissioner brought together twelve leading electronics companies in round table conferences. On the basis of these consultations, which were followed by the formation of a steering group, proposals were worked out for collaboration in five strategic fields of research and information technology. The development of this consortium recognized the need to find institutional arrangements that allow for a pooling of resources by smaller countries to pursue projects that would otherwise be beyond their means.

In the first stage of ESPRIT, the Commission worked with leading information technology firms to develop a joint strategic research and development program. The first five-year program was launched in 1984 with a budget of ECU 750 million. The first phase addressed five domains of pre-competitive research: microelectronics, software technology, information technology and processing, computer integrated manufacturing and office systems. All research priorities were set by industry representatives organized into advisory committees. ESPRIT's approach required that each project sponsored (at the rate of a 50 percent contribution from Community funds) must involve the collaboration of at least two groups from different EEC countries to encourage pan-European cooperation. One of the most progressive new initiatives under ESPRIT was the establishment of an Information Exchange System (IES) and organizational arrangements allowing for close cooperation in all technologies.

An independent review of ESPRIT in the second half of 1985 showed that the program was well on the way to meeting its objectives. As a result, a second phase for the project was planned, with special emphasis on large technology integration projects.

The Eureka Project

The EUREKA Project is perhaps the most broadly based pre-competitive research initiative yet undertaken. Nineteen nations have so far participated in at least one project under the EUREKA umbrella. In establishing EUREKA to conduct long-term high-risk research, project champion Francois Mitterand believed that the longer the term and the higher the risk the greater the requirement for public financing.

By September 1987, after a little more than two years in operation, 170 Eureka projects had already been announced. The value of these projects is estimated at about four billion ECU over their expected lifetime. Fourteen percent of these announced projects were of a duration greater than five years, and 15 percent involved at least five member nations. The focus of EUREKA is broader than that of the other research consortia discussed and includes transportation, robotics and manufacturing, lasers, biotechnology, new materials, environmental science, telecommunications, energy, and information technology.

The EUREKA organization is built upon national coordinators in each of the member countries and the EEC, as well as a EUREKA Secretariat with central authority which helps to organize ministerial conferences and high-level group meetings.

EUREKA has also created an innovative database with information on all EUREKA projects and proposals.

Judging by the rate of participation (it is still too early to judge the results of long-term research projects initiated, at the earliest, in 1985), EUREKA has been a success. This type of initiative is especially important for smaller nations and their industries, which would have great difficulty building a science-based innovation capability on their own. For EUREKA, as well as for the other research consortia, success has depended largely on the extent to which strategic industrial priorities have driven long-term pre-competitive research efforts.

The emergence of these large-scale research consortia is a response to the need for scale and critical mass in pre-competitive and basic research. These types of institutions and arrangements are the most innovative ways yet conceived of performing pre-competitive research on a large scale and of ensuring that the results of that research are diffused widely throughout the industrial bases of the countries involved.

LESSONS FOR CANADA

As noted earlier, a country's particular circumstances should dictate its approach to science and technology policy and support for pre-competitive research, as well as the appropriate roles for key participants from the public and private sectors. As with other nations, Canada's approach to basic and pre-competitive research must be tailored to its unique characteristics, including its small population, geographical disparities, history, and industrial base.

A rich endowment of natural resources has allowed Canada to sustain a high standard of living and to be one of the major developed nations of the world. Until recently, maintaining that position has not required a significant presence in basic sciences or pre-competitive research. Before World War I, Canada possessed no nationally focussed capabilities in science and applied research except in a few government departments, such as Agriculture and Mines. With the creation of the National Research Council following World War I, Canada had a research body that could form the backbone of most of the basic scientific research that took place in the nation, whether in its laboratories or in projects funded by its grants.

Today, the Canadian research community has expanded to include university labs, but still only a few Canadian companies are performing pre-competitive, long-range strategic research in Canada. Canada has a history of relying too much on university scientists to carry on commercially applicable research. Basic research is often carried out in isolation from industrial priorities and far from the offices and labs where basic research discoveries will be applied to specific technological problems and later incorporated into the design and development of commercially viable products.

Canada's experience with this research structure has demonstrated time and again that basic research in government and university laboratories is no substitute for research conducted by industry. The problem is twofold: basic research conducted without regard to the priorities of industry is not easily applied to commercial ends. Secondly, research discoveries in universities and government labs even when relevant, have not found their way into the industrial technology community because channels of diffusion are weak.

For example, research for the Premier's Council found that federal government departments and agencies hold patents on almost 1,000 products or processes developed in their laboratories. Yet less than a third of these are licensed to industry at present, with only 58 companies holding licences (see Exhibit V.3). Similarly, in 1986, Ontario university laboratories generated less than $3 million in licensing fees and royalties—a small fraction of their combined annual research budget of $366 million (Exhibit V.4).

The Premier's Council examined the ineffectiveness of government or university labs as surrogates for industrial R & D in Volume I of its report (Chapter IX). The bulk of the advanced materials research in Canada (electronic materials, metals, polymers, composite materials, and ceramics) is conducted by the National Research Council. Yet surprisingly, given the importance of materials industries in the Canadian economy, the links between NRC research labs and the industries that could use their research findings were found to be weak. As a result, research is not focussed to meet industry priorities and is often too far removed from the marketplace to produce commercially valuable results.

The problems created by Canada's history of science and technology development point to several possible lessons. Clearly it is important, given the lack of basic research by industry, that Canada establish international links with other scientific communities. The large proportion of research monies committed to government laboratories shows that Canada has not yet learned what several other countries have—that pre-competitive research aimed at industrial ends should be built on industrial priorities and managed by industrial leaders. One hopeful sign,

EXHIBIT V.3

FEDERAL GOVERNMENT DEPARTMENTS: PATENTS AND LICENSING ACTIVITY

Department or Agency	Number of Patented Products or Processes*	Current Licences	Number of Firms Holding Current Licences
National Research Council	413	129	18
Department of National Defence	208	55	7
Agricultural Canada	95	36	5
Atomic Energy Canada	90	—	—
Dept. of Energy Mines & Resources	79	28	6
Department of Communications	44	26	3
Department of Fisheries & Oceans	17	8	2
Environment Canada	12	8	3
Health & Welfare Canada	10	4	3
Transport Canada	7	6	2
All Other	22	11	9
Total	997	311	58

* Includes patents applied for.

Source: Canada Consulting Group analysis of data at Canadian Patents & Development Ltd.

EXHIBIT V.4

SOURCES OF UNIVERSITY REVENUE
1986

University	University Research Budget* ($ Millions)	Operating Grant** ($ Millions)	Licensing Fees*** and Royalties ($ Millions)
University of Toronto	$103	$ 281	$ .159
Guelph University	48	73	.417****
McMaster University	47	81	.001
University of Western Ontario	41	120	.007
University of Ottawa	33	192	.010
University of Waterloo	33	93	1.900
Queen's University	28	82	.350
York University	12	108	0
Carleton University	12	60	0
University of Windsor	6	51	0
Lakehead University	3	22	0
Total of the 11 Universities	$366	$1,163	$2.844

* Government and private sector grants and contracts.

** From Ministry of Colleges and Universities.

*** Less than 5% of this revenue is generated by the CDOs; most is from licences negotiated prior to 1985.

**** 1985.

Source: University Financial Statements (research budget and operating grants); Office of Research (licensing fees and royalties).

however, is the creation of PRECARN Associates, Inc., a non-profit corporation made up of thirty-four corporations that co-operatively sponsor, manage, and disseminate the results of long-term, pre-competitive research in artificial intelligence and advanced robotics.

PRECARN is a unique consortium for Canada in that it brings together potential users of intelligent systems technology and the potential creators of such systems. In terms of building a capacity to create new products and services in this area, PRECARN provides a unique strength; existing industries can act as the procurement sector for advanced technology firms to stimulate the development of new technologies, as well as provide an opportunity to refine and test them before they are taken into world markets. PRECARN is indeed a model for future Canadian pre-competitive research institutions.

Canada's small population, spread over a large geographic area, amplifies many of the needs of other small countries and their science and technology policies. To derive the maximum benefit from very limited resources (both financial and human), Canada needs to concentrate these resources on strategic needs and to develop co-operative approaches to identifying and focussing on areas central to Canada's industrial competitiveness. This strategic focus requires consensus, which the Japanese experience shows is a matter of gaining involvement and commitment at the most senior political and industrial levels to set priorities.

The third national characteristic with implications for our pre-competitive science and technology research policy is the country's industrial base. Two factors in Canada's industrial base are remarkable: the high degree of foreign ownership, because foreign-owned firms generally conduct less research and development than domestically-controlled firms, and low spending on R & D, even by domestically-controlled firms in Canada. Without an industrial research and development community through which to disseminate the information created by basic and pre-competitive research, the chain of industrial research, development and innovation will remain weak.

These factors—a weak research and development base in industry, a small and dispersed population, and a regionally diverse political structure—point to the need to concentrate resources in the science base if Canada is ever to achieve the critical mass necessary to use science and technology as a means of advancing economic growth and industrial competitiveness. The Ontario Centres of Excellence were the Premier's Council's response to this need for concentration. The development of sectorally focussed, pre-competitive research consortia is a complementary approach to the problem which deserves close attention.

All governments in Canada must: recognize the appropriate roles for governments, universities and industry in basic and pre-competitive research, as well as the other links in the research and development chain; ensure that, as far as possible, the performance of industry-related R & D is shifted out of government labs and into industry labs where it will receive appropriate direction; and create the environment within which the results of research are channelled to the parts of the industrial and scientific community that can use them.

As the Premier's Council recommended in Chapter IX of its main report, governments must ensure that industrial priorities play a much greater role in directing any research that does go on in government and university labs and that the private sector directs and co-funds industry-oriented research. In addition, the Council recommended incentives to accelerate the hiring of R & D, technical and engineering personnel by Ontario firms to help build competitiveness by strengthening industry's R & D capacity and filling gaps in the network through which scientific and technical knowledge is diffused. (Ontario acted on this recommendation in its April 1988 Budget when it announced the Technology Personnel Program. This program assists smaller manufacturing firms to hire new engineering and technical staff and thus improve their technological capabilities).

Together with the Council's other recommendations for supporting all stages of the industrial research and development chain, these proposals provide the means to strengthen the science and technology base Canada needs to underpin its future international competitiveness. In the long run, Ontario must move to develop a science and technology infrastructure which achieves the diffusion-oriented priorities of the German and Swedish R&D models while selectively developing mission-oriented, pre-competitive research programs in those industrial areas of significant promise for Canada. In pursuing both these objectives, industrial priorities must be given far greater prominance at all levels of decision-making.

CHAPTER VI

COMPARATIVE TRAINING STRATEGIES

Economic development and human resources development are intertwined, for the success of the policies that propel the former depends on the intellect and abilities of the latter. As the Premier's Council noted in its main report, one of the key competitive challenges faced by industry, policy makers and educators alike is that of commitment to our most fundamental natural resource: the minds and skills of our workers.

Training for Productivity

Vocational training is often viewed disparagingly as a purely social need that places a strain on our economic resources, but it should really be seen as an investment in our economic future. Skill-specific training is closely tied to productivity, a key component of competitiveness. Productivity is the ratio of goods and services produced in an economy, industry or organization relative to the resources used to produce them. Although methods of measurement vary considerably, productivity levels are generally determined by measuring the efficiency with which labour, capital, and materials are combined to produce goods and services. An efficient, skilled, and motivated labour force allows for more effective and competitive production of higher value-added goods and services.

Productivity is an important long-term contributor to economic growth, as well as a major determinant of competitiveness. The ability to sell goods in domestic and international markets often depends on production costs and productivity levels being competitive with those of other nations. Ontario's competitive position has been seriously challenged in recent years. While the province has made gains in real economic growth and job creation, productivity growth, and hence competitiveness, has lagged behind that of its major trading partners.

Increasingly, major industrialized countries are recognizing the importance of improving labour productivity through training as a means of ensuring competitiveness. Those economies that have invested in the skills of their work forces have achieved superior economic performance and superior labour market flexibility. The challenges that Ontario will face in increasing its international competitiveness will be even more formidable in the future as new technologies and trade liberalization lead to shifting patterns of demand in the labour force.

Training for Technology

Investments in capital and scientific research increase productivity and competitiveness by bringing new technology into the production process. Industries on the rise rely on new technologies to make gains in productivity, to improve product quality, and to create new or customized products and services. As industries become technology-driven, they also become progressively knowledge-intensive, placing new demands on the skills and capabilities of the labour force. Human capital thus becomes critical in the transition to an advanced industrial society.

In the same way that investment in capital resources ensures a technologically advanced and internationally competitive capital base, investment in human resources ensures high levels of productivity and international competitiveness. Because training gives people the skills to meet the demands of the market, expenditures on people are comparable to investments in facilities and equipment: both increase output and productivity. Moreover, investments in skills development, like investments in fixed capital, have benefits that extend over time and that, if neglected, lead to deterioration and obsolescence.

As the pace of technological change accelerates, the importance of investment in training to ensure competitiveness grows proportionately. Maintaining a competitive advantage often depends on the abilities of new entrants to the labour force and on the adaptability of the existing labour force in applying new technologies. Training and retraining are the only means of ensuring that ability and adaptability work in combination to meet the challenge of technological change.

The rapid introduction of new technology, coupled with changing demographic trends in the labour force, are two central reasons for increasing the emphasis on training. Ontario and Canada used to rely on immigration and the inflow of recently trained young people to supply specialized and current skills. With fewer young people and skilled immigrants joining the labour force, there will be a growing reliance on training and retraining of adult workers to meet industry demands. By 1990, the majority of the Ontario work force will fall into the 25 to 44 age group, making skills upgrading a necessity to ensure a competitive labour force.

CHALLENGES AND OPPORTUNITIES FOR ONTARIO AND CANADA

Ontario offers comparatively strong government support for training in industry, but apprenticeship and employer-sponsored training are considerably weaker in Ontario than in many other jurisdictions (See Exhibit VI.1).

There is a strong emphasis on apprenticeship in West Germany's dual training system, which clearly links skills development in educational institutions and industries. Employer support for long-term and continuing education in Japanese industry reduces the amount of government support necessary for industrial training in that country. Although the Singapore government is involved in most vocational training programs, it works in close cooperation with domestic industries and, oftentimes, foreign corporations in using human resource development as a plank for economic renewal. In Sweden, where there is considerable government support for training in industry, industry-sponsored training and apprenticeship are still more prevalent and effective than is the case in Ontario.

Of the selected countries examined for comparative purposes, all offer some degree of basic skills training that serves social or access purposes or targets disadvantaged groups. However, federally sponsored training in Canada seems to emphasize this aspect of training more than is the case in other industrialized nations.

The Training in Industry Challenge

The central challenge facing Ontario and Canada is to increase the amount and effectiveness of industry-based training. Training in industry by industry is a substantial and growing activity in Ontario. In its Survey of Employer-Sponsored Training Programs, the Ontario Manpower Commission estimated that spending on formal industrial training in the province was roughly $1 billion per year. This training commitment is dwarfed, however, by estimates for the United States, which range from $2 billion to $100 billion, depending on the figures and criteria used. The $1 billion figure for all of Ontario is comparable to what a small computer or engineering services industry might spend on training, but it represents only about half the training expenditures in the accommodation or telecommunications equipment industries. As pointed out in Volume 1 of the Premier's Council report, compared with the $2 billion spent annually on advertising and the $22 billion of capital expenditures in the province, the investment in training seems marginal.

EXHIBIT VI.1

EMPHASIS OF TRAINING APPROACHES IN SELECTED JURISDICTIONS

Jurisdiction	Government Support For Training	Industry Support For Training/ Apprenticeship	Training For Social Or Access Purposes
Ontario	✓✓✓	✓	✓✓
Canada	✓	✓	✓✓✓
West Germany	✓	✓✓✓	✓
Japan	✓	✓✓✓	✓✓
Singapore	✓✓✓	✓✓✓	✓
Sweden	✓✓✓	✓✓✓	✓✓

✓✓✓ Strong Emphasis
✓✓ Moderate Emphasis
✓ Weak Emphasis
Source: Canada Consulting Group, based on interviews and analysis.

But formal training is only a fraction of the training that Canadian firms undertake. Informal on-the-job training is the dominant and in many cases the only form of training activity in business. The amount of informal training is incalculable, as such expenditures tend not to be recorded. Yet the American Society for Training and Development suggests that informal training activity could be six times as great as formal training activity.

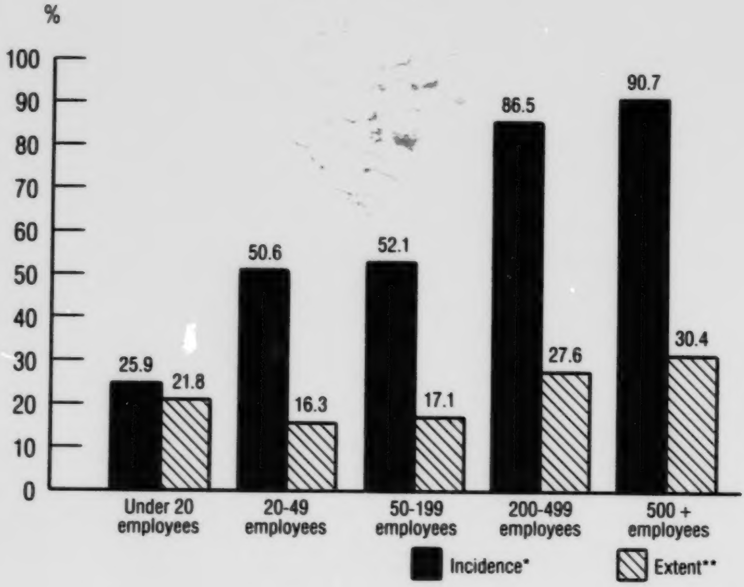
The business commitment to training throughout the industrialized world is growing. International competitive pressures and quality standards account for the rising commitment to training in the automotive industry, for example, where formal training costs since 1984 will more than double by 1990. General Motors alone is expected to provide $80 million worth of training by 1990.

Larger firms with high technological skill requirements offer the most extensive employee training opportunities. Establishments with 200 or more employees provide significantly more formal training than smaller businesses (See Exhibit VI.2). For instance, McDonnell Douglas Canada, which employs 3,000, allocates 5 percent of each employee's time to training and attributes major improvements in its productivity to this formal training activity. Another major employer, IBM Canada, is estimated to have spent $46 million in 1985 on training its 12,000 Canadian employees, each of whom received an average of 11 training days that year. Banks are also large-scale trainers, spending collectively as much as $100 million annually on formal training, according to a 1985 Canadian Bankers' Association survey.

The 1985 survey by the Ontario Manpower Commission revealed that, despite professed support for the concept of training in industry, relatively few employers in Ontario are providing training for their workers. Altogether, only 27 percent of Ontario establishments surveyed sponsor formal training programs: 24 percent of businesses with fewer than 20 employees and 86 percent of businesses with more than 200 employees provided formal training. About 80 percent of the establishments surveyed did not sponsor any qualifying or upgrading programs, though a more encouraging percentage sponsored general training programs. The incidence of formal training programs varied substantially across industries, ranging from 9 percent in primary industries to 51 percent in durable goods manufacturing, and 60 percent in public administration. Perhaps the most surprising revelation was that business and industry were largely unaware of any federal or provincial training programs.

EXHIBIT VI.2

INCIDENCE AND EXTENT OF TRAINING BY SIZE OF ESTABLISHMENT



* Incidence: Percentage of establishments with at least one person in a formal training program.

** Extent: Percentage of all full-time employees in training programs.

Source: Ontario Manpower Commission, *Survey of Employer-Sponsored Training Programs*, 1985.

POSSIBLE MODELS FOR TRAINING

Innovative concepts in industry-based training elsewhere may offer some lessons for Ontario and Canada in developing a more skilled and competitive labour force. The following discussion of training in other jurisdictions focusses on the strengths and most successful elements of foreign approaches to human resource development. Not all of these approaches are wholly adaptable to the Ontario or Canadian labour markets, given the differences in cultural, political, and policy environments. Even so, certain features of training strategies used abroad can serve as useful models for rethinking domestic training programs and directions.

A common feature of 'model' training strategies in other jurisdictions is the underlying assumption that training must be tied closely to and provided largely by industry. The concept of industry-based training takes many forms:

- West Germany's **dual training system** represents a long-standing tradition in providing skilled trades to industry and has become a world-renowned approach to coordinating basic education with skill-specific preparation for work.
- Japan's appreciation of **training as life-long education**, coupled with the recognition that a skilled, knowledgeable work force is critical to economic success, forms the underpinnings of its enviable labour market approach.
- Singapore, much like Japan, has emphasized the **connection between economic growth and the creation of a skilled labour force** in carrying out an economic redevelopment program that concentrates on increasing the value-added per employee in key manufacturing industries.
- Sweden relies on **cooperation among government, industry, and labour to meet the full employment goal** that has driven the aggressive training and retraining focus of its industrial restructuring policies.
- Although U.S. training policy at the federal level is fragmented and often ill-defined, certain state training efforts are exemplary in their recognition of **training as a partnership** between business and educational institutions.

THE WEST GERMAN APPROACH

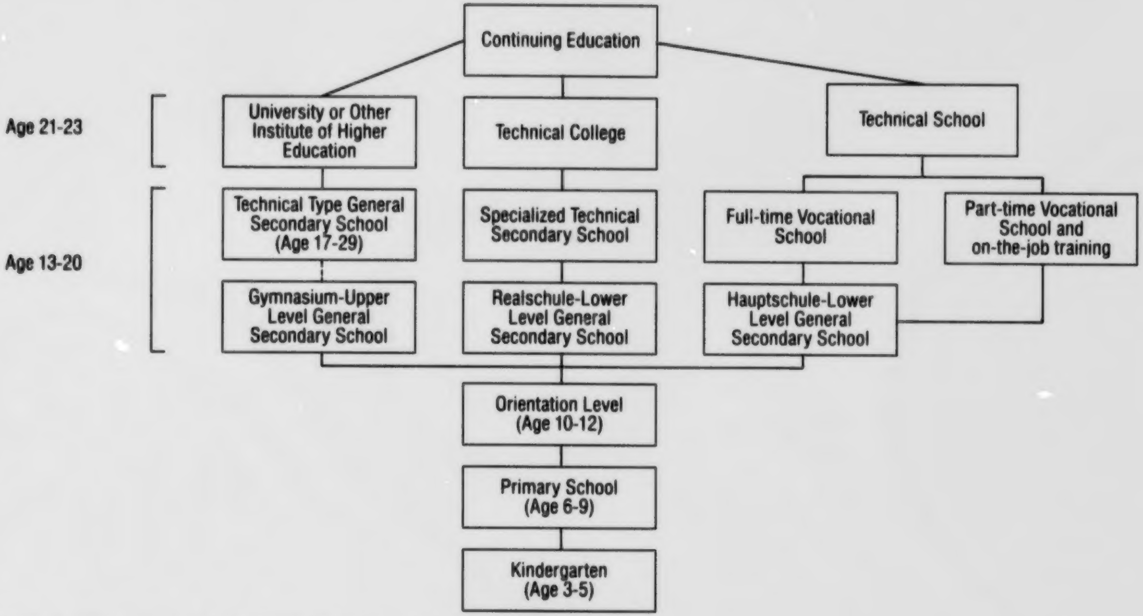
The Dual Training System

The Federal Republic of Germany has adopted a training strategy and approach that recognize the fundamental link between training and industry performance. Training activity is centred in the dual system, an extensive occupational training regime that combines formal education with in-firm training. An emphasis on vocational training involving cooperation among labour, government, and private business is the hallmark of the West German approach.

This approach was shaped by legislation emerging from a decade-long debate over the nature of the education system, the role of vocational training, and the respective responsibilities of government, employers, workers and unions. This postwar debate culminated in the enactment of the federal *Vocational Training Act* and the *Employment Promotion Act* of 1969 and the *Works Constitution Act* of 1972. The combined effect of these laws was

EXHIBIT VI.3

STRUCTURE OF THE WEST GERMAN EDUCATION AND TRAINING SYSTEM


Continuing Education
Age 21-23
University or Other Institute of Higher Education
Technical College
Technical School
Age 13-20
Technical Type General Secondary School (Age 17-29)
Specialized Technical Secondary School
Full-time Vocational School
Part-time Vocational School and on-the-job training
Gymnasium-Upper Level General Secondary School
Realschule-Lower Level General Secondary School
Hauptschule-Lower Level General Secondary School
Orientation Level (Age 10-12)
Primary School (Age 6-9)
Kindergarten (Age 3-5)

Source: Press and Information Office, Government of the Federal Republic of Germany, 1987.

to strengthen the role of unions to determine, in cooperation with employers, most matters relating to the employment and use of human resources, including training and retraining.

The West German system offers students completing their general secondary school education a range of vocational schools, technical schools, and combination apprenticeship/school programs from which to choose. Adult workers wishing to upgrade their skills also have a broad selection of extension and trade school options open to them. The result is a complex system of entry-level and upgrading training carried out by a variety of education and training institutions (See Exhibit VI.3).

One invaluable aid in negotiating this maze is an extensive and sophisticated government-sponsored system of vocational and occupational counselling carried out by the Federal Employment Institute. Managing the breadth and diversity of the vocational and industrial training system requires consensus among its government, employer, and union partners. The Federal Institute of Vocational Training facilitates this consensus process by representing the social partnership among the major players on matters of legislation, training standards, and related issues.

The effectiveness of the West German training system is largely a result of the fact that all participants—the two levels of government, employers, and unions—coordinate their efforts and develop a coherent training policy despite their somewhat different viewpoints. Employers have resisted attempts to move towards a stronger role for institutions in training or to have controls imposed on firms from outside. Trade unions have tended to favour increased public control and financing of vocational education and training, as well as a broader and more integrated system of publicly funded and controlled entry-level and continuing training. Governments have occupied a middle ground by emphasizing the employment aspects of training and the need for the work force to adapt to structural change by promoting development of appropriate vocational curricula and legislating educational leave policies.

Despite these differences in approach, all players in the training system share a recognition of the importance of training at the entry level and beyond and a belief that higher levels of economic performance depend on investing heavily in the development of human resources.

Key Features of the Dual System

A shared belief in the importance of vocational training has facilitated the functioning of West Germany's dual training system. Training is split between the firm and the part-time vocational school. On-the-job training is subject to federal law, whereas classroom instruction is subject to the laws of the individual Laender or provinces. Firms provide vocational training voluntarily and at their own expense in order to obtain the trained young people they require. In concluding a vocational training contract, the firm runs the risk of losing newly-trained, skilled personnel to other firms. On the other hand, the company can also hire skilled personnel trained elsewhere. Therefore, ensuring a supply of young trained personnel is in the interests of not only a single firm but all occupations and economic sectors.

The dual system has been particularly successful at managing the school-to-work transition. Moreover, the differentiated educational system in West Germany contributes a far greater amount of vocational preparation and specialization at the secondary school level than is the case in Ontario. Although the optional school leaving age in both West Germany and Ontario is 16, only 10 percent of West German youth, as opposed to 70 percent of Ontario youth, attempt to enter the labour force directly upon completion of high school as unskilled labour.

West German youth who have completed their full-time compulsory education commonly elect to learn one of the approximately 430 state-recognized occupations for which accredited vocational training is required. They opt overwhelmingly for the dual system of vocational training, under which they concurrently receive on-the-job training and attend vocational school part-time. This training is generally available to anyone and is not contingent on receipt of a particular school-leaving certificate.

The effectiveness of the dual training system is so widely recognized that it has become a model for other countries whose cultures can adapt to the system. The Federal Republic of Germany refers to its dual system as "an export commodity in great demand", citing examples of other nations that have sought to emulate this system. For several years, West Germany has cooperated with the People's Republic of China in efforts to reform the Chinese vocational training system along the lines of the dual system. Ecuador, South Korea, Thailand, and Turkey are among the other countries that have looked to the Federal Republic for advice in establishing nation-wide vocational educational systems.

The Apprenticeship Tradition

The West German apprenticeship system, now represented by the on-the-job portion of the dual training approach, is a tradition that can be traced back to the Middle Ages. As early as the twelfth and thirteenth centuries, professional organizations (guilds) established regulations governing the training of the next generation of craftsmen. Until the beginning of the nineteenth century, only the merchant and craft trades trained apprentices. As the country became more industrialized, this form of training spread to industry and in the twentieth century to all economic and occupational sectors.

Apprenticeship in West Germany thus has a proven success record in responding to the needs and interests of unions and employers. The resource commitment to training in industry, and apprenticeship in particular, is substantial. The German Economic Institute estimates that $14 billion (Canadian) or 1.75 percent of GNP was spent on industrial training in West Germany in 1982. About 70 percent of that amount was spent on apprenticeship training, and employers contributed about 80 percent of the total cost of entry-level and continuing industrial training.

In 1985, the cost of vocational training borne by firms was roughly 20 billion DM (net). Approximately 500,000 firms now provide on-the-job or apprenticeship training. Training employers can be found in virtually all manufacturing and service sectors (See Exhibit VI.4). Traditionally, the 'craft' or skilled trades accounted for the bulk of youth training in West Germany. Industry and commerce now represent the major training ground by occupational sector.

THE JAPANESE APPROACH

Life-Long Education for Economic Growth

The Japanese approach to human resource development is notable for its articulation of explicit links between training and economic success. This approach is supported and complemented by a strong legal framework, a comprehensive training policy, a sound training infrastructure, and an effective research and information network.

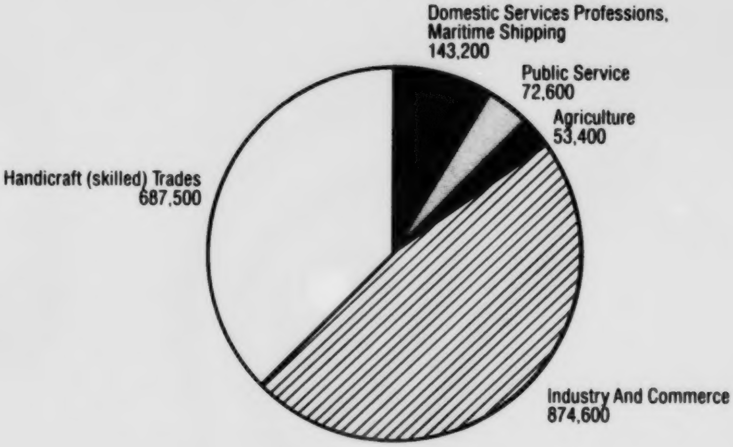
The goals of Japan's vocational training policy illustrate the importance attached to training in the country's overall economic strategy. Training is seen as a life-long endeavour, rather than something that begins and ends with the development of initial job skills. There is an emphasis on training for the already-employed to help them adapt to changes in the country's industrial structure, technological advances and extended work life

EXHIBIT VI.4

WEST GERMANY

NUMBER OF TRAINEES IN OCCUPATIONAL SECTORS
1985 Training Year

Total Number of Trainees: 1.8 Million



Source: Press and Information Office, Federal Republic of Germany, 1987.

(the retirement age, once 55, is gradually being increased to 60 and 65).

The industry commitment to developing human capital is highly visible. Japan's strong economic performance in the past 20 years has been widely attributed to human resource development strategies and programs carried out at the level of individual firms. Training is central to those strategies. Almost all large Japanese firms (98 percent) provide vocational training for both new recruits and existing employees, and 58 percent of smaller businesses (those with 30 to 99 employees) carry out training for new and existing employees.

Japan's formal education system stresses academic rather than vocational training, and post-secondary recruitment tends to be based on personal attributes and academic achievement more than specific skills. Although high school students are tested to determine whether they are college or trade school material, many are recruited by employers at age 18 and trained to meet specific company requirements.

Training Policy Levers

The Vocational Training Law of 1979 assigns to employers the principal obligation to provide training opportunities for their employees, making entry-level training for new workers and upgrading training for those already employed a private sector responsibility. The law also sets standards for the licensing of vocational instructors, establishes government-run training centres, and certifies workers through annual trade skill tests.

Several public sector organizations are responsible for gathering information about training programs and their effectiveness by identifying both the need for and the supply of industrial training. The Institute of Vocational Training, established in 1958, serves an important function by training vocational instructors, conducting research into training, and facilitating international technological cooperation. It also provides some updating of training for industrial workers. All vocational instructors at public facilities and government-sanctioned private training centres must be licensed and obtain their training there.

Private training programs—those sponsored, for example, by trade unions, employers, employer associations, or co-ops—can obtain financial and other assistance from government, including access to public training facilities, instructors, and teaching materials. They may also receive subsidies to cover a portion of the cost of operating the program or purchasing training facilities. Small businesses are eligible for a higher percentage of cost reimbursement and often form co-ops with this support to train the employees of several firms.

The efficiency of Japan's training system is a product of comprehensive policy, coherent goals, and an extensive information base. Programs and policies have changed infrequently, and then only for reasons of shifting or longer-term economic and industrial strategies. The training system's responsiveness to the changing needs of industry is exemplary. Government sponsorship of competitive awards in curriculum development and training excellence is also instrumental in maintaining the high standards of the education and training systems. But the underlying reason for strength of the Japanese approach is a shared and practised belief that a skilled and motivated labour force is the country's primary resource and the basis of its competitive advantage.

THE SWEDISH APPROACH

The Full Employment Policy

The industrial training system in Sweden is part of an active labour market policy that aims to promote full employment. Sweden's highly unionized labour force and the climate of cooperation that exists among labour, industry, and government have shaped this policy and the legislation that supports it. Collective bargaining and co-determination in industrial relations have yielded significant labour market gains, including the enshrinement of educational leave in legislation and the enhancement of employer-sponsored training.

A key component of Sweden's full employment policy is its youth guarantee, which gives every young person under 20 who is enrolled in a secondary school the right to a place in a vocational training program or a special youth job. Another interesting operational feature of this guarantee is that school leavers remain the legal responsibility of the municipal school authority, but upon reaching age 18 they become the responsibility of a local employment service.

Programs to Promote Full Employment

A program designed to retrain adults who are unemployed, who risk unemployment, or whose skills are in need of updating complements existing full employment initiatives for the older work force. The Labour Market Training program, formerly administered by the National Labour Market Board, is now being run by a new commission, established in January 1986, to offer training and educational services on a commercial basis to companies, administrative organizations, and other employers.

The National Labour Market Board is a tripartite body that facilitates implementation of government labour market policies and contributes to their development by bringing information and expertise about labour market conditions to bear in a way that government alone cannot. The Board views training as the most important instrument of labour market policy because of its ability to influence labour supply through such factors as occupational mobility. The significance attached to training is underscored in the Board's budget, about a quarter of which is devoted to training, while programs to promote geographical mobility of the labour force account for only one percent.

Although the Board does not deliver training services, until 1985 it did administer the principal government training program for adults. The actual training was arranged by the National

Board of Education through local labour boards and training and employment assessment centres.

Industrial restructuring in mature sectors like shipbuilding, steel, and mining has forced a radical rethinking among unions and employers about retraining and further training. One result has been the evolution of a range of innovative training instruments and approaches within Swedish companies. Government support for these developments through labour market policies and funding has inspired a new recognition of the value of investing in human resources.

The Company Commitment to Training

Two developments in particular have reinforced the commitment of Swedish employers to retraining. Because labour legislation requires long notice periods before employees can be laid off, it is often less expensive for employers to retrain than to reduce their labour forces. The introduction of legislation requiring companies realizing a certain level of profits to direct 10 percent of their profits to a renewal fund has also had an impact on employers' attitudes to retraining. Renewal funds can be used to finance training expenditures as well as research and development.

Even without these measures, though, Swedish companies have historically devoted considerable resources to training and developing their employees. The estimated total training costs (including wages) of Swedish companies was estimated to be about three percent of payroll during the 1970s. Swedish companies also have a tradition of experimenting with alternative forms of work organization, participatory management systems, programs to improve the quality of working life, and other types of human resource management systems.

THE SINGAPORE APPROACH

Skilled Labour for Economic Redevelopment

When the government of Singapore undertook a major economic development program during the 1970s, a strong work ethic and low-wage labour were the underpinnings of its strategy. By the 1980s, Singapore had attracted more than 500 foreign companies to invest in the country, creating well over 150,000 direct manufacturing jobs and at least three times as many jobs in supporting service and manufacturing establishments. After reaching full employment, the government established a program to increase the value-added per employee in industry by:

- investing heavily in upgrading workers' skills;
- using incentives to increase the extent of R & D, management functions, and marketing carried out by companies in Singapore;
- raising wages in industry and establishing some taxes on industry to fund these efforts;
- discouraging low value-added investments from abroad.

The result was a substantial improvement in the country's knowledge infrastructure and an increase in more sophisticated foreign investment. However, Singapore also experienced stagnation in employment and GDP growth as low value-added facilities closed and new investment in low value-added markets declined.

As part of Singapore's new economic development effort, a series of programs to improve the country's ability to increase the value-added of jobs was introduced. These programs involved the establishment of training institutes and the expansion of engineering and scientific education universities. Other measures included the establishment of research and development institutes, a science park, inventories to support company research and development as well as encourage commercialization of R & D activities, and a venture fund for new high technology companies.

In the area of training specifically, the government committed more than $40 million annually to training funds and provided grants of $6 million annually to indigenous firms for automation and related employee training. To address the need for more advanced technological and scientific skills, the government embarked on a crash effort to double the proportion of engineers in the work force.

The government's efforts to develop and expand the pool of scientific and technological manpower in Singapore have apparently met with success. From 1981 to 1985, total R & D manpower increased from 2,741 to 4,886, while the number of research scientists and engineers per 10,000 in the labour force doubled from 10.4 to 20.2. The expansion of two universities to educate scientists accounts in part for the increases already realized and those that are still anticipated. The National University of Singapore had 1,720 students in its engineering faculty in 1985 and by 1990 is expected to take in between 1,200 and 1,400 annually. Similarly, the Nanyang Technological Institute expects its

1985 engineering enrollment of 2,000 students to increase markedly by the 1990s.

Manpower Development Programs

Singapore has established a vocational training system that capitalizes on the resources of industry and the experiences of other countries. Its major training initiatives are directed by the Economic Development Board (EDB), which operates programs involving the cooperation of industry, government and, in many cases, foreign corporations.

The EDB runs seven training institutes, each offering facilities that simulate factory environments. Each institute is set up in cooperation with a foreign government or major corporation:

- The three Craftsmen Training Centres provide high school graduates with two-year work and study programs in precision and CNC machining, tool and die making, and precision mechanisms. Each centre operates in conjunction with foreign industry: Philips Electronics of the Netherlands, Brown-Boveri of Germany, and Tata of India.
- Another three of the EDB centres are Institutes of Technology, which provide two-year training programs for engineers, technologists, and computer professionals. Each institute receives partial funding from the three foreign governments under which they are jointly operated. The three institutes are the German-Singapore Institute for Production Technology, the French-Singapore Institute for Electronics & Control Technology, and the Japan-Singapore Institute for Software Technology.
- There is also a technical training centre, the Japan-Singapore Technical Institute, which was set up to train maintenance technicians in a two-year course focussing on mechanical electronics, industrial electronics, and instrumentation and control. The first 83 trainees graduated in 1986.

All of the EDB centres involve close cooperation between the Singapore government and industry, as well as foreign corporations. As a result, Singapore's high school training programs offer a combination of government, industry, and international expertise.

In addition to these training institutes, the EDB also operates the Continual Upgrading Program, which trains workers already on the job. Eight specialized programs are offered in cooperation with existing companies in Singapore:

- IC Design/CAE Training with Mentor Graphics;
- Industrial Robotics Interfacing and Programming with Seiko;
- Industrial Robotics and Programming with Sankyo Seiki;
- CAD/CAM Training with Computervision;
- CAD/CAM Training with Hewlett-Packard;
- CNC Technology with Japax Group;
- Metrology with Mitutoyo.

Continual Upgrading Training programs run for six months and cater to skilled workers, technicians, and maintenance engineers. Since 1983, more than 300 courses have been offered, involving over 3,000 participants from industry.

The EDB also sponsors the Skills Development Fund, which encourages employers to upgrade the skills of their workers. It is the employer's responsibility to identify specific training needs and find companies with the resources to do the training. Once objectives have been established and a training company has been identified, the SDF provides grants to cover 30 to 90 percent of allowable training costs. Almost $40 million was spent in 1985 by the Singapore government on these programs, in which more than 10,000 workers participated.

The Skills Fund also provided $14 million in grants to companies to initiate training programs in new technology. Some $6 million was provided to assist indigenous companies in mechanizing their facilities and training employees in the use of new automation.

The SDF group administering these incentives also participated in the establishment of 11 industry training centres to meet the common needs of specific industrial sectors, ranging from textiles to contracting to the hospitality industry. In general, SDF complements the training initiatives of industry by providing both support services and financial assistance when and where they are necessary.

SELECTED U.S. STATE TRAINING PROGRAMS

There is no explicit federal policy on industrial training and human resource development in the United States. The position taken by the federal government is that training is the responsibility of the individual states and the private sector. Although states, counties, and cities are often major players in vocational education and training, their programs have been directed primarily at job creation and employment, with little regard to training as an instrument of industrial strategy. Although the U.S. federal training approach should not be regarded as a model, certain innovative concepts at the state and local levels are nevertheless worth examining.

The Focus on Training Partnerships

The Bay State Skills Corporation of Massachusetts represents one innovative state approach to training. Created in 1981 as a quasi-public, state-funded organization, the Corporation acts as a catalyst in developing and financing training programs carried out in educational institutions to serve the needs of one or more firms. State grants are matched by the private sector partner firms to cover the costs of each training program approved. More than 200 academic institutions and 1,000 companies have participated in the program since its inception. Of the more than 19,000 people who have received training, 87 percent have been placed in jobs.

The Bay State Skills Corporation became the model for skills corporations in Florida, Kentucky, Minnesota, and Washington. The Sunshine State Skills Corporation in Florida invested $700,000 in skills training conducted in colleges during its first year of operation (1985). Kentucky's Bluegrass State Skills Corporations, created in 1984, awarded almost $600,000 for 76 programs at 27 educational institutions serving 159 companies; approximately $3.1 million in private sector support was acquired in this way. The Minnesota Job Skills Partnership, started in 1983, has funded 21 projects involving 24 educational institutions and 80 companies. From 1983 to 1985, the Washington Job Skills Program funded 39 projects, representing a $2 million investment by the state and the private sector.

The California Employment and Training Panel is composed of business, labour, and government members and focusses on adult retraining. Federal law does not allow unemployment insurance funds to be used for training, but the California legislature circumvented this barrier by reducing the unemployment insurance tax paid by employers by $55 million annually and imposing a new state employment training tax. The state contracts to pay between $1,000 and $5,000 per person who completes a specified training program and moves into a job that is directly related to that training. Employers and schools conduct job training and receive reimbursement after the employee has remained on the job for 90 days.

The Ben Franklin Partnership for Advanced Technology and the Customized Job Training Program, both in Pennsylvania, have leveraged a combined $282 million in private industry support since 1982, together with a $75 million state contribution. While the Partnership has an impressive early record for company start-ups and expansions (200 start-ups and 175 firms expanded during the program's first 34 months), the Customized Job Training Program meets the needs of companies interested in locating and expanding in Pennsylvania by offering training assistance. The program will cover 100 percent of a company's training costs if its project meets program requirements, the most important of which is guaranteed job placement.

THE CANADIAN POLICY ENVIRONMENT

The Government Commitment to Training

The Ontario government's commitment to training increased from $50 million in 1985-86 to $100 million in 1986-87. The major focus of provincial training is short-term training in industry through efforts like the Ontario Skills Program. This industrial component of the Ontario Training Strategy represented $68 million, while access programs—those directed at improving basic and work force entry skills—accounted for the $32 million balance of the province's training effort in 1987.

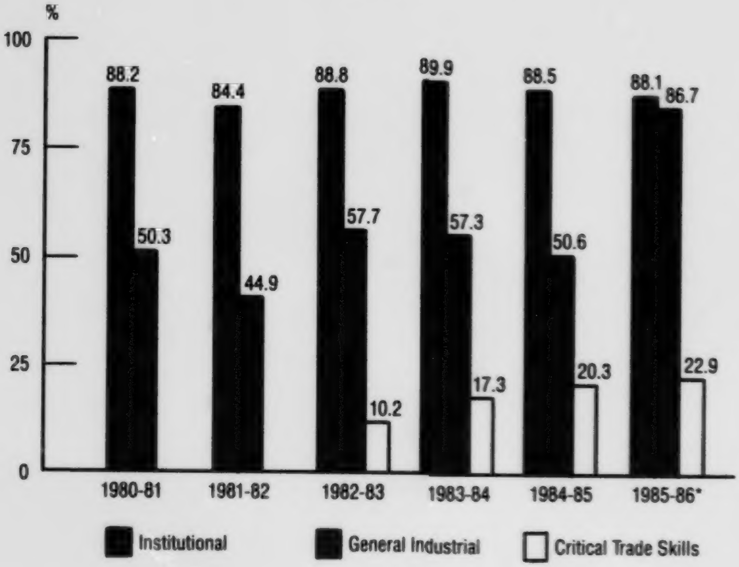
Federal Emphasis on Access Programs

The federal government spent more than four times as much as the provincial government on training in Ontario in 1986-87. However, the bulk of the $430 million in federal training funds spent in Ontario was for social or access programs. The federal training mandate in Ontario, as in the other provinces, tends to emphasize the social rather than the industrial goals of training. Almost 90 percent of individuals in federally sponsored programs were unemployed, indicating that a major objective of the federal training initiative is to allow people to enter or re-enter the work force, instead of developing or honing industry-specific skills (See Exhibit VI.5). It is also significant that institutional training conducted in community colleges represented 55 percent of total federal training expenditures, while training in industry represented only nine percent (Exhibit VI.6).

The Canadian Jobs Strategy (CJS), introduced in 1985, emphasizes training as one component of the federal government's broader labour market policy. The Strategy's six program streams—skill investment, skill shortages, job development, job entry, community futures and innovation—contain vestiges of earlier federal training programs, but the target group of people eligible for training has been defined more narrowly and rigidly. The focus of the CJS has become the disadvantaged and the hard-

EXHIBIT VI.5

% OF INDIVIDUALS IN FEDERALLY SPONSORED FULL-TIME TRAINING PROGRAMS WHO ARE EMPLOYED
% CANADA



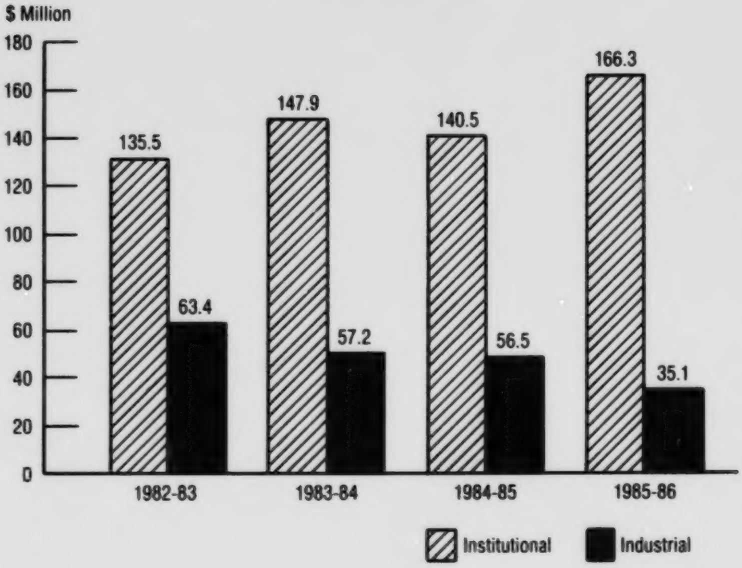
Note: Unemployed includes those not in the labour force.
*Introduction of Canadian Jobs Strategy and change of criteria for programs.
Source: Canada Employment and Immigration Commission, Statistical Bulletin.

to-employ members of the work force. Meeting the needs of industry is not a principal goal of the Strategy. The benefits of the program streams are consistently defined in terms of ensuring equitable representation of target groups, with secondary emphasis on benefits accruing to employers and industry.

Federal spending on training programs falls into two main categories: institutional training, which covers seat purchases at community colleges and financial support for trainees at education training institutions, and industrial or employer-sponsored training, which involves support to employers for the cost of training and a portion of trainees' wages. Federal funds are also, but less frequently, devoted to capital spending in training institutions. The federal government traditionally spends the major portion of its funding on institutional training (See Exhibit VI.6).

EXHIBIT VI.6

FEDERAL EXPENDITURES ON INSTITUTIONAL AND INDUSTRIAL TRAINING IN ONTARIO



Note: Industrial training includes general industrial training, critical trade skills training and non-institutional component of Skill Shortages and Skill Investment streams of the Canadian Jobs Strategy in 1985-86.
Source: Canada Employment and Immigration Commission, 1987.

With the introduction of the Canadian Jobs Strategy, spending on industrial training for those occupations deemed to be in short supply declined. The CJS also cut back significantly on industrial training for occupations demanding high-level skills. Consistent with the CJS objective of focussing training expenditures on those members of the labour force most in need, spending has been redirected to employer-based training where workers' jobs are threatened by changing technology or economic conditions.

Ontario received about 27 percent of federal training monies in 1985-86 and participated most heavily in the skills shortages and institutional programs. Approximately 28 percent of all participants in federal training programs were residents of Ontario (See Exhibit VI.7).

EXHIBIT VI.7

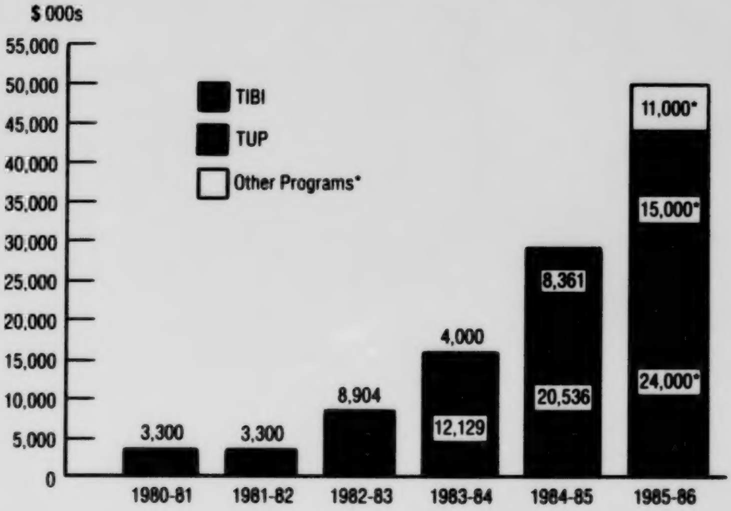
ONTARIO'S PARTICIPATION IN FEDERAL TRAINING PROGRAMS

Federal Training Program	Number Of Ontario Participants	% Of Ontario Program Participants	% Of Total Federal Participants	
Job Development	19,972	15%	21%	
Job Entry				
Challenge '85	21,729	16%	25%	
Other Job Entry	8,520	6%	36%	
Skill Shortages	**8,128**	**6%**	**56%**	INDUSTRIAL TRAINING
Skill Investment	**2,067**	**2%**	**46%**	
Community Futures	1,070	1%	12%	
Institutional Training	65,275	49%	31%	
U.I. Section 38	5,496	4%	30%	
Total	132,257	100%	28%	

Source: CEIC, 1987.

EXHIBIT VI.8

DIRECT EXPENDITURES ON INDUSTRIAL TRAINING BY THE ONTARIO GOVERNMENT

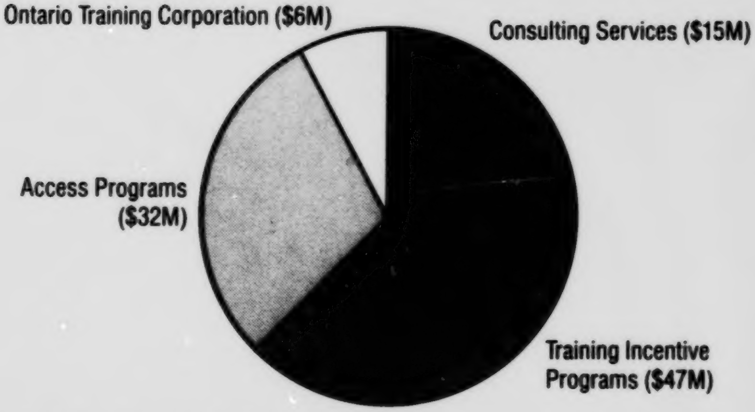


* The extra $11 million was used for support of the Community Industrial Training Committees ($8 million), the Ontario Training Incentives Program ($5.9 million), older workers HELP centres ($1.2 million), Training Trust Funds ($5 million), International Marketing Intern Program ($2.9 million), women in skilled trades ($0.3), employment sponsored training centres ($0.2).

Source: Ontario Ministry of Skills Development, 1987.

EXHIBIT VI.9

ONTARIO'S $100 MILLION TRAINING COMMITMENT



Source: Ontario Ministry of Skills Development, *Skills Ontario*, 1988.

Implications of Federal Training Policy for Ontario

Ontario has benefitted from federal training opportunities. But the implications of federal training strategies for Ontario extend beyond the issue of how well the province has capitalized on these national programs. Another equally important set of implications relates to the development of Ontario's own training programs as a consequence of and a response to the federal approach. Ontario has had to respond to the federal government's cuts in financing for job training programs: the $2.1 billion allocation for 1987-88 was significantly reduced to $1.4 billion in 1988-89. Furthermore, the federal government's predilection for using training as a tool to alleviate unemployment and improve access to the labour market by disadvantaged Canadians reaffirms the need for Ontario to set industrial development and economic growth as its primary objectives in developing training policy.

Shortcomings in the industrial and competitive aspects of the national training program have affected the province's training agenda. As well as avoiding duplication of federal training initiatives, Ontario has tried to concentrate on programs that develop a strong industrial training base. The establishment of the Ontario Ministry of Skills Development was a significant first step in promoting a new awareness of the importance of quality training for the province's industrial development and international competitiveness. Other recent measures, such as the launching of the $100 million Ontario Training Strategy, also exemplify the province's commitment to setting a new course for training based on the realization that it represents a powerful economic development tool.

Since 1980, the province has steadily increased its annual financial commitment to industrial training programs (See Exhibit VI.8). In 1986-87, the province doubled its training commitment from $50 million to $100 million and created the Ontario Training Strategy (OTS), which places additional emphasis on training in and for industry. The four cornerstones of the OTS are the Training Incentive Programs ($47 million), Access Programs ($32 million), the Consulting Service ($15 million) and the Ontario Training Corporation ($6 million) (See Exhibit VI.9).

The OTS offers five main services. The consulting service operates through the Ontario Skills Development Offices in colleges of applied arts and technology to assist firms that have offered little or no training in the past in developing training opportunities. The program focuses on businesses with fewer than 200 employees, as these are the firms that traditionally offer the fewest training programs. As of September 1987, 52 consulting offices were in operation.

In addition to providing consulting services, the OTS subsidizes training costs to industry on a sliding scale to a maximum of $60,000. Again, the emphasis is on stimulating training in those smaller firms unlikely to provide training on their own initiative. Firms with fewer than 200 employees receive subsidies covering 80 percent of training costs, while larger firms receive 60 percent subsidies. More than half the program money is allocated to firms belonging to the former category.

Other major OTS projects include short-term training programs for workers in skilled trades, access programs to remove barriers that disadvantaged individuals or groups might encounter in entering basic skills training programs, and the Ontario Training Corporation, designed to develop training products and services and to maintain an information link between providers and consumers of training.

Historically, the strategies of the Ontario government in the area of training policy were a response to federal training policies and programs and the funding arrangements attached to them. Increasingly, however, Ontario has taken the lead in developing its own training mandate and strategies to carry it out. Ontario is also becoming more active in pursuing changes in federal training schemes, rather than merely acting in response to them. This has been demonstrated in Ontario's advocacy of changes to the Canada Training Allowance to allow more funding to retrain those who are employed or recently unemployed and increases in income support for apprentices during their in-school training.

Despite progress in revamping the province's training system, long-standing problems in the apprenticeship system have yet to be fully addressed. A number of factors inhibit the apprenticeship system from functioning effectively. Some of the problems stem from inadequacies in the *Apprenticeship and Tradesmen's Qualification Act*, which provides the legislative base for the system. The Act's outdated wage provisions, ratios and training guidelines have led to inflexibility in dealing with new and changing training needs. The Act and its Regulations also stipulate lengthy training periods—up to five years for some trades—before apprentices achieve journeyman status and this contributes to a significant dropout problem.

The apprenticeship system is also burdened by an excessive administrative workload, which dominates the activities of local Industrial Training Consultants, who carry out the system in the field. Registration, monitoring, and accreditation of trainees are their primary tasks, while counselling, community liaison, training promotion, and assessing employer needs receive less attention.

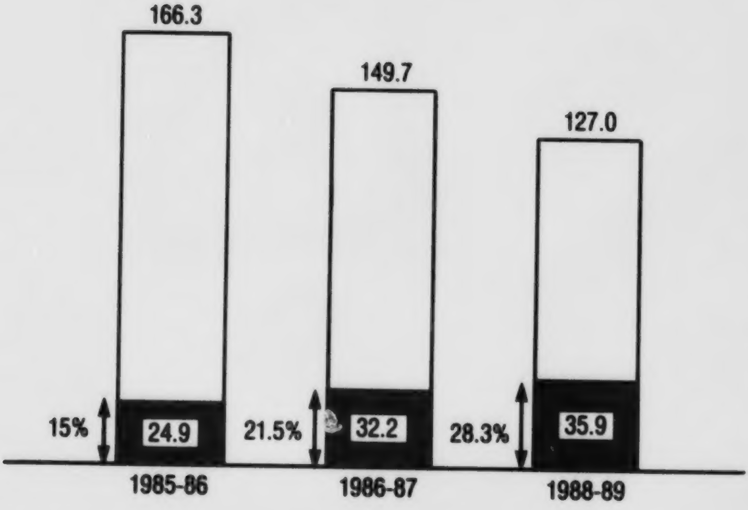
The need to improve the efficiency of the apprenticeship system and ensure that it is more responsive to employers' and apprentices' needs has become more urgent now that federal funding mechanisms, particularly for the in-school portion of apprenticeship training, have lapsed. Because the apprenticeship system does not fit into one of the six streams of the Canadian Jobs Strategy, federal funding for this area has dwindled to the point where Ontario must commit increasing amounts to its apprenticeship programs, often at the expense of other training programs (See Exhibit VI.10).

As a result, several fresh approaches to apprenticeship are being explored. These include pre-apprenticeship programs for women and greater use of co-op models to allow for alternative ratios of in-school to on-the-job training; establishment of a pilot mechanism to enable employers to take on entry-level employees and provide formal on-the-job training; and expanded support for journeymen to upgrade skills through a trades updating program.

EXHIBIT VI.10

SHARE OF ONTARIO'S FEDERAL TRAINING ALLOCATION USED FOR APPRENTICESHIP

($ Millions)



Source: Ontario Ministry of Skills Development; *Globe and Mail*, 3 August 1988.

In mid-1987, the government launched a $14 million initiative to expand Ontario's apprenticeship program. It included provisions for new training approaches and training in new trades, as well as measures to attract more women, assist with apprentices' tool purchases, and stimulate the government's own apprenticeship programs. This initiative is expected to develop an additional 20,000 apprentices within the next five years.

RECOMMENDATIONS FOR ONTARIO

Policy-makers in Ontario have already recognized and begun to address some of the training challenges facing the province. Unfortunately, the federal government and many industries in Canada have yet to recognize fully the twofold goals of successful training strategies: that training must be directed by industry demand and provided, for the most part, by industry as well. These assumptions certainly underlie the successes of many foreign training policies.

Although Ontario's training strategy is designed to create incentives for more industry-based training, the effectiveness of this effort has yet to be determined. Furthermore, a broader range of options has yet to be explored and tested before Ontario can develop the comprehensive people strategy called for in Volume I of the Premier's Council report.

The Council concluded that the work force of today and tomorrow must first be equipped with the basic literacy and numeracy skills that will allow them to gain employment and continue to function effectively in the workplace. But it is also imperative that they receive skill-specific training that is compatible with the needs of industry. Government's role in reaching this objective should be to ensure that incentives are in place to increase training for industry and by industry.

The Council also acknowledged that its preliminary investigations into the adequacy of the education, training, and labour market adjustment measures must be followed up with a more intensive investigation into a number of other critical areas, including:

- the low literacy and basic skills levels of the work force, and the availability of basic skills upgrading opportunities to meet their needs;
- the shortcomings of the apprenticeship system and how these can best be addressed;
- methods of increasing the amount and quality of training by industry through incentives or a regulatory framework;

- the special training needs of older workers in restructuring industries and employment fields where major adjustments are occurring;
- the role of training in industrial adjustment, particularly in comparison to the training-for-adjustment experience of other countries.

The Council's next round of research and discussion will focus on these 'people' issues in order to develop a set of initiatives that build on existing efforts to revamp the province's education, training, and labour adjustment systems. This new agenda will also complement the economic development program outlined in the Council's main report.

APPENDIX A

Listed below are the organizations which were consulted in connection with the Premier's Council report. In most cases, more than one individual from each organization was interviewed. In some, many more were involved. Altogether, some 1000 people were consulted.

AB Biologicals/Agritech
A.D. Burford International Ltd.
A.G. Simpson
Abitibi Price
Acres International
Advanced Electronic Systems
Advanced Fiberoptics
Algoma Steel
Alias Research
Allelix
American Biotechnology
Antel-Optronics
Arrow Shirts
Arthur Anderson & Company
Association of Industrial Managers of Quebec
Association of Major Power Consumers of Ontario

Babcock & Wilcox Canada
Bank of Nova Scotia
Barringer
Beaver Canoe
Bell Northern Research
Bi-Cadd Systems
Biologicals
Bryston

CAE Electronics
CGI Information Systems
C.I.L.
CME Ltd.
CMT Steel Co.
CRS Plus
Cable, Howse & Ragen
Calmos Systems Inc.
Campbell Soup Company Ltd.
Canada Packers

Canada Systems Group
Canadair
Canadex
Canadian Advanced Technology Association
Canadian Auto Workers Union
Canadian Bioclinical
Canadian Chemical Producer's Association
Canadian Drug Manufacturers Association
Canadian Export Association
Canadian Fusion Fuels Technology Project
Canadian Institute for Advanced Research
Canadian General Electric
Canadian General Investments
Canadian General Tower
Canadian Imperial Bank of Commerce
Canadian Nuclear Association
Canatom Inc.
Cangene
Canon Canada
Cansult Engineering
Cimtek Automation
Chiefton Products
Cognos Inc.
Com Dev
Communications and Electrical Workers of Canada
Complax Corp.
Comterm
Conestoga Medical (CME)
Consulting Engineers of Ontario
Consumers Packaging
Control Data Canada
Corel Systems
Costeel
CyberFluor Inc.

DMR Group
de Havilland
Denison Mines Ltd.
Devtek
Digital Equipment Corp.
Digital Media Network
Diversified Research Group (Geo Weston)
Dofasco
Domglas
Donlee Precision

Dow Chemical Canada
Doyletech
Dresser Industries
Dupont Canada

EDA Instruments
ENS Biologicals
Ecolaire Canada Ltd.
Educational Software Products
Eldorado Resources Ltd.
Electrical & Electronic Manufacturers' Assoc. of Canada
Electrohome
Energy Probe
Esso Chemical Canada
Exceltronix Inc.
Export Development Corporation

Ford Motor Company of Canada
Fulcrum Technologies

Gandalf Technologies
Garrett
Geac
Genelcan
General Motors of Canada Limited
George Weston Co.
Gigatek
Grayrock Ventures
Grocery Products Manuf. of Canada
Guaranty Trust

Harris Steel
Helix Investments
Hematite Manufacturing
Hewlett Packard
Honeywell
Howden Group Canada Limited
Human Computers Resources (HCR)
Husky Injection Molding

I.A.F. Biochem
IBM Canada
I.P. Sharp and Associates
ITT Canada
Image & Audio Systems
Information Technology Assoc. of Canada
Innovative Systems Group (ISG)

Innovus
Interactive Image
Interbake Foods
International Verifact
Intermetco
Isolation Systems

Japan External Trade Relations Organization (JETCO)
John Labatt Ltd.
Junior Achievement of Canada

Kaufman Footwear
Kellogg Salada
Keeprite
Kettle Creek Canvas Co.
Koch Engineering Co.
Kodak

LN Technologies
Labatt Breweries
Lake Ontario Steel
Lamson & Session
Lanpar
Lavalin
Legalware
Levesque, Beaubien
Linear Technology
Litton Systems
Long Mfg.
Lumonics
Lynx Technologies

MBM Ceramics
MPB Technologies
McDonnell Douglas
Magna International
The Manufacturers' Life Insurance Co.
Marshall Macklin Monaghan
Meiogenics
Menasco
The Meridian Technologies
Merrill Lynch of Canada
Mil-Vickers
Mitel
Monaco Group
Monenco Consultants Limited
Moniteq

Monserco Ltd.
Motor Vehicle Manufacturers' Association
Multiplan Inc.

NABU Network
Neilson's Ltd.
Noranda Enterprises
Northern Telecom
Numetrix

Ontario Federation of Labour
Ontario Film Development Corporation
Ontario Food Processing Association
Oppenheimer & Co.
Organization of Candu Industries
Ortho Canada
Oseco
Overseas Projects Corp. of Canada

PRA International
Palladin
Pharmaceutical Manufacturers' Assoc. of Canada
Pharmaglobe Labs
Placer Dome Inc.
Plastic Engine Technology
Polysar
Pratt & Whitney Canada
Praxis
Pure Data

Q-4 Instruments
Q.S.I. Inc.

R.G. Schoniker and Associates
Raytheon
Redpath Sugars
Ria Inc.
Rio Algom
Robin Kay Knitwear
Rockwell International
Ronald A. Chisholm Limited
Royal Bank of Canada
Royal Trust

SB Capital
SHL Systemhouse Inc.
SNC International Ltd.
Sacda Inc.

Seltech Industries
Silex Noise Control
Society Plastics Institute
Softquad
Software Ontario Corp.
Solar Plastics Extrusions
Solarchem
Sonco Steel Tube
Spar Aerospace
Spectra-Physics
Spectrix
Square D
Stange Canada
Stelco
Sun Life Assurance
Syntonics Ventures

Telepanel Inc.
TIL Systems
Timberjack
Toronto Dominion Bank
Toronto Medical
TRW

Ultra Lasertech
Union Carbide Canada
Unisys
United Steelworkers of America, District 6 (Ontario)

Vadeko International
Velcan Inc.
Venture Economics Canada
Videtics

Walbar
Watcom Group
Waterloo Engineering Software
Waterloo Scientific
Westinghouse Canada
Weston Bakeries
Wood Gundy
Woodbridge Group
Woodbridge Reed
Worth Technologies

Xerox Canada

Zenon Environmental

Academic and Related Institutions

Algonquin College
école Polytechnique
Guelph-Waterloo Biotech

Harvard University

Lakehead University

Massachusetts Institute of Technology
McGill University
McMaster University

University of Guelph
University of Michigan
University of Toronto
University of Waterloo
University of Western Ontairo
University Technology Corporation

York University

Canadian Government Departments and Agencies

Atomic Energy of Canada Ltd. (AECL)
Bank of Canada
Biotechnology Research Institute

Canada Employment and Immigration Commission
Centre de Recherche Industrielle du Quebec

Department of Communications (Canada)
Department of Employment and Immigration (Canada)
Department of Energy, Mines and Resources (Canada)
Department of External Affairs (Canada)
Department of Finance (Canada)
Department of Industry, Science and Technology (Canada)
Department of National Defence (Canada)
Department of Supply and Services (Canada)

Export Development Corporation

Federal Business Development Bank

Governor's Office for Job Training (Michigan)
Innovation Ontario

Hydro Quebec

Management Board of Cabinet (Ontario)
Medical Research Council

Ministry of Agriculture and Food (Ontario)
Ministry of Colleges and Universities (Ontario)
Ministry of Consumer and Commercial Relations (Ontario)
Ministry of Education (Ontario)
Ministry of Energy (Ontario)
Ministry of Environment (Ontario)
Ministry of Industry, Trade and Technology (Ontario)
Ministry of Financial Institutions (Ontario)
Ministry of Labour (Ontario)
Ministry of Natural Resources (Ontario)
Ministry of Northern Development and Mines (Ontario)
Ministry of Revenue (Ontario)
Ministry of Skills Development (Ontario)
Ministry of State for Science and Technology (Ontario)
Ministry of Tourism and Recreation (Ontario)
Ministry of Transportation and Communications (Ontario)
Ministry of Treasury and Economics (Ontario)

National Research Council
Natural Sciences and Engineering Research Council

Ontario CAD/CAM Centre
Ontario Centre for Automotive Parts Technology
Ontario Centre for Farm Machinery and Food Processing Technology
Ontario Development Corporations
Ontario Film Development Corporation
Ontario Hydro
Ontario Institute for Studies in Education
Ontario Municipal Employees Retirement Fund
Ontario Research Foundation

Plant Biotechnology Research Institute

Quebec Industrial Research Centre
Quebec Ministry of External Trade and Technology Development
Quebec Ministry of Finance
Quebec Ministry of Labour and Income Security
Quebec Secretariat of Canadian Intergovernmental Affairs
Quebec Securities Commission

Science Council of Canada
Société de Développement Industriel du Quebec
Statistics Canada

Task Force on the Investment of Public Sector Pension Funds (Ontario)

FOREIGN INDUSTRIAL POLICY INTERVIEWS

France

Anvar

Commissariat a l'energie atomique

Elie Cohen, maitre de conference a la I.E.P.
Electricite de France

Pascal Lamy, chef de cabinet du president
de la Commission des Communautes Europeenes
(Former head of CIRI in France)

Germany

Bavarian State Ministry of Economics
Bessy

Daimler-Benz
Dornier

Federal Ministry of Economics (BMW)
Federal Ministry for Research and Technology (BMFT)
Festo
Fraunhofer Institutes
  —Production Engineering & Automation
  —Interface & Biochemical Engineering
  —Engineering & Robotics

Heidelberg Instruments
House of Economics

Information Technology

Krone

Max Planck Institutes
  —Metals Research

Nuclear Research Centre, Karlsruhe

Research Institutes
  —Microelectronics
  —Molecular Biology
  —Aviation & Space Flight

Steinbeis Foundation

Technology Centres
  —VDI/VDE
Technology Parks

—Karlsruhe
—Heidelberg
Technology Transfer Centre
—Berlin Technical University
Trumpf

Zahnradfabrik

Sweden

Gunnar Ribrant (founding manager of Industrifonden)

Industrifonden

Ministry of Finance
Ministry of Industry

Swedish Central Bank
Swedish National Board for Technical Development

Other European

Alvey Programme, Department of Industry and Trade (London)

Directorate General of Internal Markets and Industrial Affairs, European Community (Brussels)
Directorate General of Telecommunications, Information Industries, and Innovation, European Community (Brussels)

Esprit Program Secretariat, European Community (Brussels)
Eureka Secretariat (Brussels)
Euroventures B.V. (Eindhoven)

Philips International B.V.

Japan

Agency for Industrial Science and Technology

Council for Science and Technology

Institute of Laser Science

Japan Science and Technology Agency

Ministry of International Trade and Technology

National Space Development Agency of Japan

Research Development Corporation of Japan

Korea

Economic Planning Board

Korea Institute for Economics and Technology

Ministry of Education
Ministry of Trade and Industry

Singapore

Economic Development Board

United States

Congressional Budget Office
Corporation for Enterprise Development

Department of Commerce
Department of Defense—DARPA
Department of Defense—ManTech
Department of Defense—VHSLIC Program

Illinois Bureau of the Budget

Manufacturing Technology Program—Air Force
Maryland Montgomery County High Technology Council
Massachusetts Bay State Skills Corporation
Massachusetts Business Development Corp.
Massachusetts Capital Resource Company
Massachusetts Centre for Excellence Program
Massachusetts Community Development Finance Corporation
Massachusetts Industrial Finance Agency
Massachusetts Industrial Service Program
Massachusetts Product Development Corporation
Massachusetts Technology Development Corporation
Massachusetts Technology Park Corporation
Massachusetts Thrift Institution Economic Development Fund
Michigan Development Office
Michigan Strategic Fund
Microelectronic Computer and Technology Corporation

National Governors' Association
National Research Council—Manufacturing Studies Board
National Science Foundation

Office of Technology Assessment
Ohio Department of Development

Pennsylvania Ben Franklin Partnership
Pennsylvania Department of Commerce—PIDA

Small Business Innovative Research Program

Tennessee Department of Economic and Community Development

Thomas Edison Program (Ohio)

The Urban Institute
University of Illinois—SIMS Project
University of Iowa—Iowa Basic Skills Test Group

APPENDIX B
THE MAIN ONTARIO AND FEDERAL INDUSTRIAL ASSISTANCE PROGRAMS

Industrial assistance in Ontario is provided at both the provincial and federal levels is provided either directly through grant and loan programs or indirectly through tax incentives. Both levels of government deliver assistance to industry through grant or loan mechanisms administered by a central government agency. The Ontario Development Corporations (ODCs) serve this function in Ontario, while the recently renamed Department of Industry, Science and Technology (DIST) has inherited this role from the former Department of Regional Industrial Expansion (DRIE) at the federal level. Given the corporate tax structure in Canada, indirect assistance for industrial development through various tax measures is predominately a federal incentive tool, centred in the federal Department of Finance. This appendix describes the major provincial and federal program delivery mechanisms that play an important role in supporting business growth and development. The only areas excluded from this discussion (because they are covered elsewhere) are vehicles for promoting R & D, entrepreneurship, education and training.

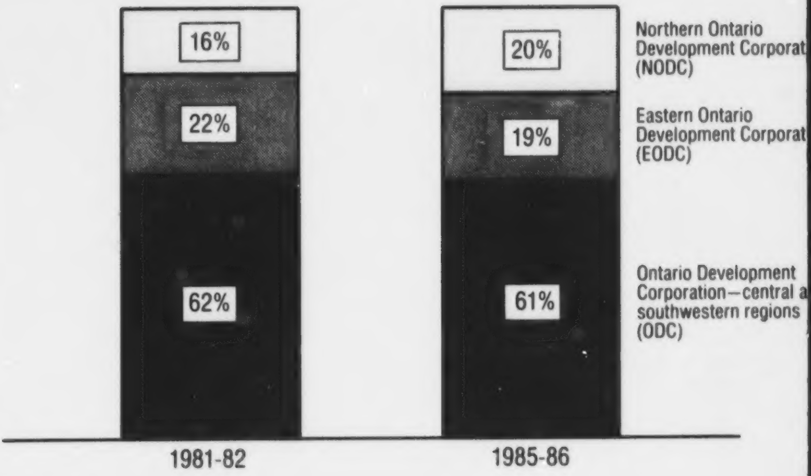
ONTARIO'S INDUSTRIAL ASSISTANCE FRAMEWORK

The Ontario Development Corporations are the main vehicles for delivering assistance to industries in the province. The mandate of the ODCs—to encourage and assist in the development and diversification of industry in Ontario—is carried out primarily through lending and investment activities which focus on business start-ups, expansions, and high-risk ventures. The Corporations also provide advisory assistance to businesses, administer financial assistance programs on behalf of other provincial agencies, and assume responsibility for implementing and administering federal-provincial regional development agreements. The recently created Innovation Ontario Corporation also falls under the ODCs' administration.

The three ODCs—the Ontario Development Corporation, the Eastern Ontario Development Corporation, and the Northern Ontario Development Corporation—have a strong regional presence in the areas of the province they serve. But the Ontario Development Corporation, representing central and southwestern Ontario, traditionally accounts for almost two-thirds of the ODCs'

EXHIBIT B.1

DISTRIBUTION OF LOANS BY CORPORATION
Ontario Development Corporations



Source Ontario Development Corporations

combined loan dollars, while loan dollars per capita are significantly higher for the northern region (See Exhibit B.1).

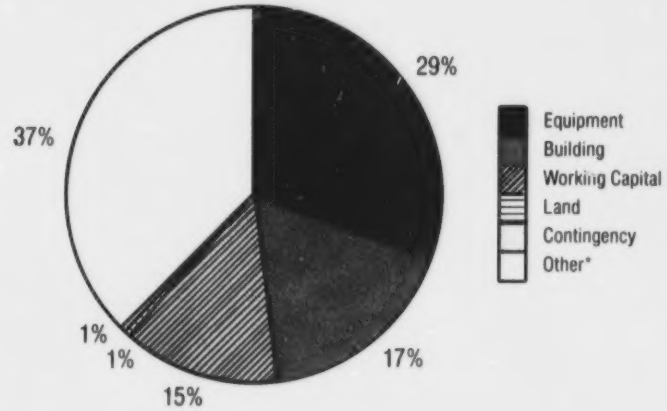
The ODCs have a variety of financing mechanisms at their disposal. They provide traditional term loans, incentive term loans (which may be interest-free or feature deferred repayment of principal), interest subsidies up to a certain percentage, loan guarantees, and incentive loan guarantees that offer an interest subsidy. The Corporations may offer a revolving line of credit or demand loans to finance export receivables. They also have an interest-free forgivable loan option that permits companies meeting certain criteria to have 50 percent of their loan forgiven after the first year and the balance forgiven after the second. In exercising these various lending options, the ODCs accumulated an outstanding loan portfolio of $700 million by the end of 1986.

The aim of the ODCs is to assume risk at levels above those usually assumed by the private sector and the Federal Business Development Bank. As a consequence, their loan losses amount to three to four percent of total activity, compared with just over one percent for the chartered banks and just over two percent for the FBDB. In addition to the high risk factor that governs the

EXHIBIT B.2

USES OF PROJECT FUNDS
Ontario Development Corporations
1985-86

Total Project Funds = $379.2 Million



*Consulting fees, lawyers' fees, initial costs and intangibles, general administrative, recruitment
Source: Ontario Development Corporations

ODCs' lending decisions, regional and social considerations such as employment creation also figure prominently in the assessment of applications. Assistance is directed mainly to the development and expansion of manufacturing industries through new plant and equipment financing and support for upgrading of tourist facilities (See Exhibit B.2). Some of the shortcomings of ODCs' current lending approach are discussed in Chapter III of the Council's main report.

The ODCs' new financing agency, Innovation Ontario, services a different business constituency. It concentrates on providing financial assistance to newer ventures requiring funds for new product and prototype development. While Innovation Ontario targets industries and investment needs not covered under the Development Corporations' mandate, it is a relatively small program, offering a maximum of only $250,000 in funding per project.

THE FEDERAL APPROACH TO INDUSTRIAL ASSISTANCE

Federal assistance to business is delivered through three distinct mechanisms: grant and contribution programs residing in various industry-related departments, tax incentives offered through the finance department, and Crown agency loans provided primarily by the Federal Business Development Bank to assist small business. In addition to these forms of assistance, the federal government also provides ad hoc assistance in the form of corporate bailouts and short-term restructuring programs to prop up troubled industry sectors. The common focus of the various federal programs is to assist economically disadvantaged regions, small and medium-sized businesses, and exporting industries in marketing their products.

Federal assistance to business is contained largely within the economic and regional development envelope, representing about 10 percent of total federal expenditures. In terms of total dollars, spending for industry is dominated by two small business loan funds, the Small Business Loan Administration (SBLA) and the Federal Business Development Bank (FBDB). Another key program within this spending envelope is the Defence Industry Productivity Program (DIPP). The Industrial and Regional Development Program (IRDP), which was terminated on June 30, 1988, also fell within the economic and regional development envelope. Of the $10 billion devoted to economic and regional development, just over 20 percent ($2.2 billion) is used specifically for industrial and technological support; infrastructure, agricultural support and energy-related programs account of the balance (See Exhibit B.3).

IRDP: The Core Industrial Assistance Program

IRDP was one of the federal government's major industrial assistance programs. While spending through IRDP was considerably less than spending on other industry programs, its support of industries and technologies with the greatest potential for economic return, sustained growth, and international competitiveness made IRDP an important industrial development tool. Although the program was sunset on June 30, 1988, expenditures will continue for a few more years to meet outstanding commitments.

Like other federal industry programs, however, IRDP was intended to promote regional industrial development (See Exhibit B.4) through private sector financing and to respond particularly to the needs of small and medium-sized businesses. Financial assistance was also made available to nonprofit organi-

EXHIBIT B.3

AVERAGE ANNUAL VALUE OF FEDERAL INDUSTRIAL ASSISTANCE PROGRAMS

Average Of Period 1983-86
Millions of Dollars

	Total Spending	Ontario Portion	%
Small Business Loans Act (SBLA)	$868* (loans)	$217	25
Federal Business Development Bank (FBDB)	523 (loans)	118	23
Industrial & Regional Development Program (IRDP)**	217	60	27
Economic & Regional Development Agreements (ERDA)***	215	6	3
Defence Industry Productivity Program (DIPP)	159	40	25
Canadian Industrial Renewal Board	53	21	38
External Affairs Marketing Programs (PEMD)	44	19	42
Shipbuilding Assistance	27	5	17
Business & Industrial Program	27	5	17
Book Publishing	9	3	33
Total	$2,143	$494	23

* This is the value of loans guaranteed by the government; claims are approximately 5%

*** IRDP is 39% non-repayable monies.

** Includes Regional and Industrial Expansion agreements only

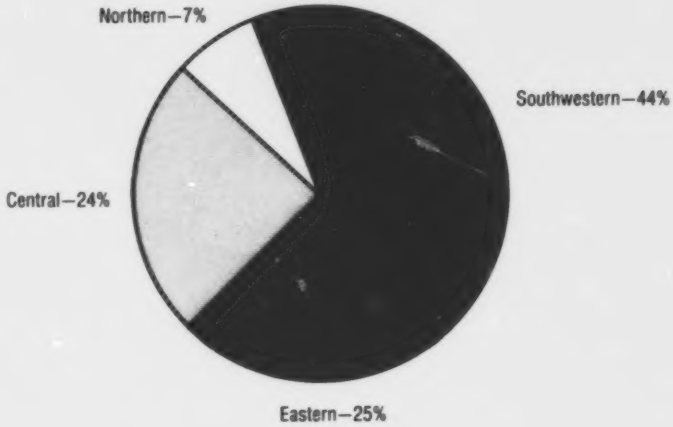
☐ Indicates loan programs

Source: Canada Consulting Group analysis based on published sources.

EXHIBIT B.4

DISTRIBUTION OF IRDP EXPENDITURES BY REGION
1985-86

Total Loans = $32.7 Million



Source: IRDP

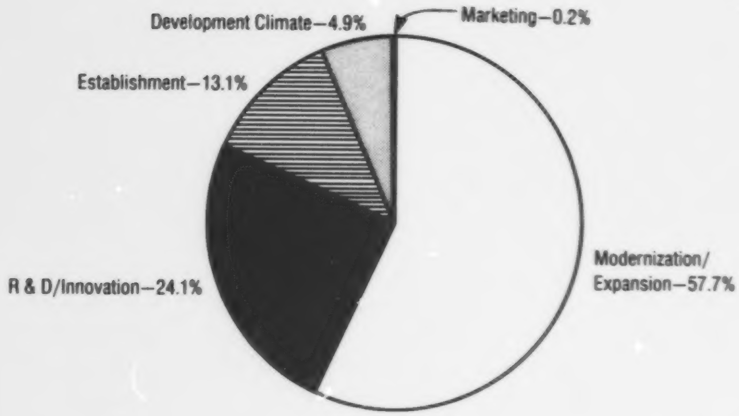
zations through outright or repayable contributions. Projects eligible for financing included feasibility studies, product and process innovations, new plant establishment, modernization or expansion of existing facilities, and marketing. The program aimed to provide, on average, $1 for every $5 of approved project costs, and project funding from all government sources, including investment tax credits, could not exceed 90 percent of the project costs.

In 1985-86, IRDP's expenditures in Ontario were $32.7 million. A thumbnail sketch of IRDP financing activity shows that repayable contributions were the most common type of assistance provided (almost 60 percent); plant modernization and expansion expenditures accounted for close to 60 percent of IRDP monies by planning element (See Exhibit B.5); and the largest chunk of funding (just over one-third) went to the machinery and transportation equipment industries. Some of the shortcomings of IRDP are discussed in Chapter III of Volume I.

EXHIBIT B.5

IRDP EXPENDITURES BY PLANNING ELEMENT
Ontario
1985-86

Total Loans = $32.7 Million



Source: IRDP.

The Small Business Financing Programs

The objective of the Federal Business Development Bank (FBDB) is to promote the development of small and medium-sized businesses by providing them with a range of financial and management services. The fact that these services are designed to supplement rather than compete with those offered by the private sector, together with the FBDB's small business bias, has earned this agency the reputation of being a lender of last resort, a distinction it seems to share with the ODCs.

FBDB's term lending to small business is non-discriminatory in terms of the sectoral focus; manufacturing, retailing, restaurant, hotel and recreational sectors all benefit from FBDB's lending largesse (See Exhibit B.6). There is no bias towards businesses that are exporting or conducting research and development; in fact 95 percent of loan recipients are non-exporters, and 98 percent do no research and development (See Exhibit B.7).

Another contradictory aspect of the Bank's loan activity is its ability to combine last-resort lending with a venture capital approach oriented to the bottom line. Surprisingly, FBDB is one of

EXHIBIT B.6

FBDB TERM LENDING ACTIVITIES BY INDUSTRIAL SECTOR

Canada

Industry	Fiscal 1986 Number Of Loans (% Distribution)	Amount Authorized (% Distribution)
Manufacturing	20.2%	27.5%
Restaurants, Hotels & Recreation	22.6	26.4
Retail Trade	18.6	11.7
Wholesale Trade	5.7	5.8
Rental Properties	11.4	13.0
Construction	4.4	2.8
Transport	4.2	4.2
Agriculture	1.8	1.0
Others	11.1	7.6
Total	100.0%	100.0%

Source: FBDB

the largest providers of venture capital to small firms in Canada. While FBDB is a prolific and aggressive venture capital vehicle, it assumes a passive role in the management of these investments once they are made and plays no active part in bringing investors together.

The federal Small Business Loan Administration, operating since 1961 under the SBLA Act, is another major source of funding for small business. The SBLA is essentially a loan guarantee program in which government guarantees 85 percent of the value of loans by chartered banks to businesses with under $2 million in revenue. These loan guarantees are primarily for funding equipment purchases or for buying or renovating premises. In 1986 SBLA guaranteed more than 20,000 loans with a total value of $738 million. Claims paid that year amounted to $44 million, placing the default rate at an inordinately high six percent.

EXHIBIT B.7

FBDB TERM LENDING ACTIVITIES BY EXPORTS AND RESEARCH AND DEVELOPMENT

Canada

	% Distributions	
	Fiscal 1986	
	No. of Loans	Amount Authorized
Export Sales		
Exporter	5.0%	12.0%
Non-exporter	95.0%	88.0%
Total	100.0%	100.0%
Research and Development		
Businesses Conducting R & D	2.0%	5.0%
Businesses Not Conducting R & D	98.0%	95.0%
Total	100.0%	100.0%

Source: FBDB.

Export Assistance Programs

The Export Development Corporation (EDC) provides incentives for foreign purchasers to buy Canadian capital goods and services by financing up to 85 percent of the Canadian contract value. EDC also provides insurance and guarantee services to Canadian exporting firms of any size. Although there is a high risk factor in EDC's financing (the Corporation often finances transactions considered too risky by private banks), it has traditionally shied away from the type of concessional financing provided by its foreign counterparts in France, West Germany, and Japan, for example.

Regional preferences and size of firm are not among EDC's financing criteria. A rising percentage of Ontario companies have become EDC clients since 1984, and large firms have come to dominate the corporation's financing and insurance activity (See Exhibits B.8 and B.9).

The Program for Export Market Development (PEMD) takes a different approach to enhancing the export capability of Canadian firms. PEMD's mandate is to encourage more firms to export

EXHIBIT B.8

EXPORT FINANCING BY SIZE OF COMPANY

Canada

Company Size By Annual Sales (Dollars)		1986	
		Volume (%)	No. Of Companies (%)
Very Small	(<1,000)	2.4	10.0
Small	(1,000-5,000)	5.4	10.0
Medium	(5,000-25,000)	3.9	10.0
Large	(25,000-100,000)	20.5	27.0
Very Large	(>100,000)	67.3	43.0
		100.0	100.0
		Total Volume: $588 Million	Total No. Of Companies: 48

Source: Export Development Corporation Annual Report, 1986.

EXHIBIT B.9

EXPORT INSURANCE BY SIZE OF COMPANY

Canada

Company Size By Annual Sales (Dollars)		1986	
		Volume (%)	No. Of Companies (%)
Very Small	(<1,000)	2.7	32
Small	(1,000-5,000)	8.1	29
Medium	(5,000-25,000)	16.0	22
Large	(25,000-100,000)	14.3	8
Very Large	(>100,000)	58.9	9
		100.0	100.0
		Total Volume: $2,641 Million	Total No. Of Companies: 1,321

Source: EDC Annual Report, 1986

by sharing some of the risks of entering new markets. The program is also designed to encourage businesses that have not exported previously to enter the export market and to provide incentives for established exporters to expand their activities in new markets.

PEMD provides up to 50 percent of specifically defined costs incurred by a company in its penetration of new markets. Contributions are repayable only if sales are made to that market. The repayment rate is two percent of gross sales per year up to the full amount received over three years. Between 1971 and 1986, program expenditures totalled $178 million, of which only $8 million has been repaid. This low recovery rate, attributed to lax recovery procedures in the early years of the program, is currently being addressed through more rigorous tracking measures.

PEMD objectives are carried out through an eight-fold program covering

- specific project bidding,
- market identification trips,
- participation in trade fairs abroad,
- assistance to incoming foreign buyers,
- encouragement of Canadian export consortia,
- sustained export market development,
- PEMD funds to develop export markets for agriculture, fisheries and food products, and
- contributions to nonprofit organizations involved in export activity.

PEMD assistance is extended only to incorporated businesses, professional firms and national, nonprofit, non-sales trade organizations or associations. Applicants must also be export-ready in order to qualify for assistance. Export-ready businesses are defined as having been established and operating in Canada for at least two years or having annual sales exceeding $100,000. They must also demonstrate satisfactory marketing and managerial capabilities and the financial ability to complete the project. The product to be exported must have 60 percent Canadian content, based on input costs. Despite these requirements, far too much of PEMD's financing activity is directed to small businesses that are probably too tiny to succeed in export markets (See Chapter III of Volume I).

Statistics on PEMD activity indicate a turndown ratio of 28 percent of total applications received, and the program is generally over-subscribed. In 1985-86 PEMD received more than 5,000 applications, of which 68 percent were approved; over the life of the program, 45,000 applications have been received and 72 percent of them have been approved. In 1985-86 more than 60 percent of approved PEMD applications were in manufacturing, and more than half were from companies with less than $2 million in sales.

The Sectoral Focus Of DIPP

The Defence Industry Productivity Program (DIPP) is one federal program designed to provide assistance to a specific group of industries. The objective of DIPP is to develop and maintain strong Canadian defence-related industries capable of competing successfully over the long term in domestic and export markets. The program objectives also include the development and maintenance of a defence-related production capability and an advanced defence-related technological capability.

DIPP offers both repayable and non-repayable contributions through four basic types of assistance: research and development, source establishment, capital assistance, and market feasibility (including product prototyping). In 1985-86, research and development assistance accounted for 82 percent of DIPP's $247 million in authorized assistance. The preponderance of DIPP funding by major industry group went to transportation equipment, which is understandable, given the extent to which aerospace manufacturing dominates the defence market (See Exhibit B.10).

Ad Hoc Responses to Industrial Assistance

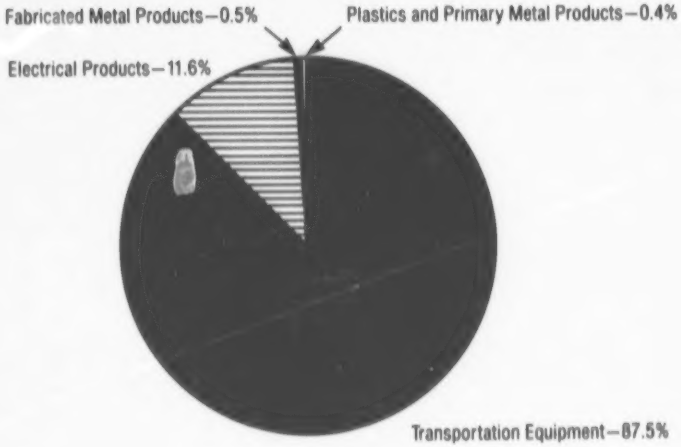
Corporate bailouts are the federal government's favoured method of providing short-term assistance to individual companies undergoing severe financial difficulties. Crises are managed by government injecting new funds directly into the troubled business (grants, low-interest or interest-free loans) or providing indirect assistance through loan guarantees. Whatever the precise form of assistance, it is usually directed to fixed assets or working capital to enable the company to stay afloat long enough to turn its fortunes around or to enable the community and labour market to absorb the employment dislocation resulting from the firm's eventual shutdown.

Government bailouts tend to be in the form of loan guarantees rather than cash grants. In return for government assistance, companies make commitments to undertake regional development

EXHIBIT B.10

DIPP AUTHORIZED ASSISTANCE
Major Industry Group
Canada
1985-86

$247.1 Million



Source: DIPP

activities by maintaining employment levels, for instance. Corporate commitments sometimes involve new asset acquisition and product research and development. By using stop-gap measures that focus on regional development, bail-outs usually offer short-sighted solutions that often ignore an industry's broader economic realities and restructuring needs.

A much more effective way of assisting ailing industries is through sector-specific programs, ideally phased in when a crisis is just beginning and phased out once that crisis has subsided. The federal Shipbuilding Industry Assistance Program was one example of a program developed to respond to an anticipated downturn in an industry sector. The Canadian Industrial Renewal Board is another federal mechanism that attempted to use a far-sighted restructuring approach to salvage endangered industries before they become unsalvageable.

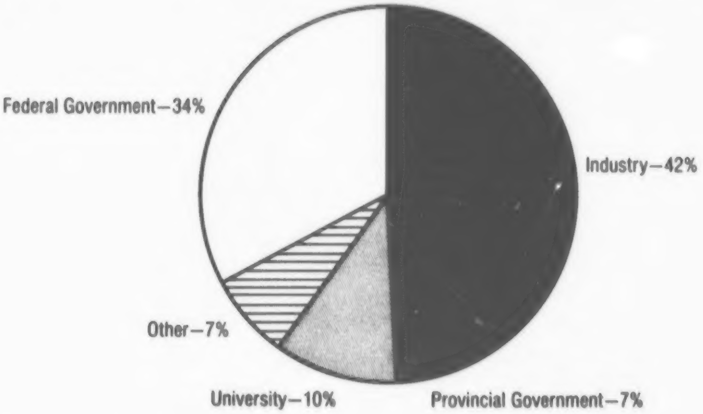
APPENDIX C
CANADA'S PUBLIC SECTOR SCIENCE AND TECHNOLOGY INFRASTRUCTURE

Government spending on Canada's science and technology infrastructure has been discussed at various points in the Premier's Council report. This appendix offers a more detailed analysis of federal and Ontario science and technology expenditures than it was possible to include in the main report.

The public sector science and technology infrastructure plays a major role in Canada's overall research and development effort. Fifty-eight percent of the country's R & D budget comes from the public sector, and close to half of all research and development is carried out in government departments and agencies and in universities (See Exhibits C.1 and C.2). The largest portion of expenditures comes from the federal level, with the provinces playing a role in activities specific to their jurisdiction. One quarter of all R & D in Canada is performed in universities, which receive most of their funding for that purpose from the federal government.

EXHIBIT C.1

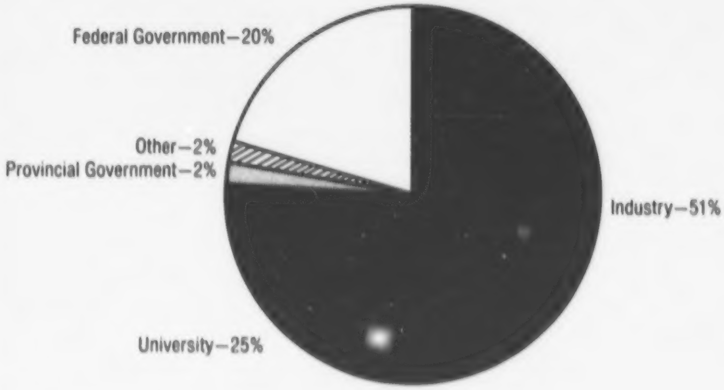
WHO SUPPLIES THE MONEY FOR R & D IN CANADA
1987
$7.1 Billion



Source: Statistics Canada, Science Bulletins.

EXHIBIT C.2

WHERE THE MONEY ON R & D IS SPENT IN CANADA
1987
$7.1 Billion



Source: Statistics Canada, Science Bulletins

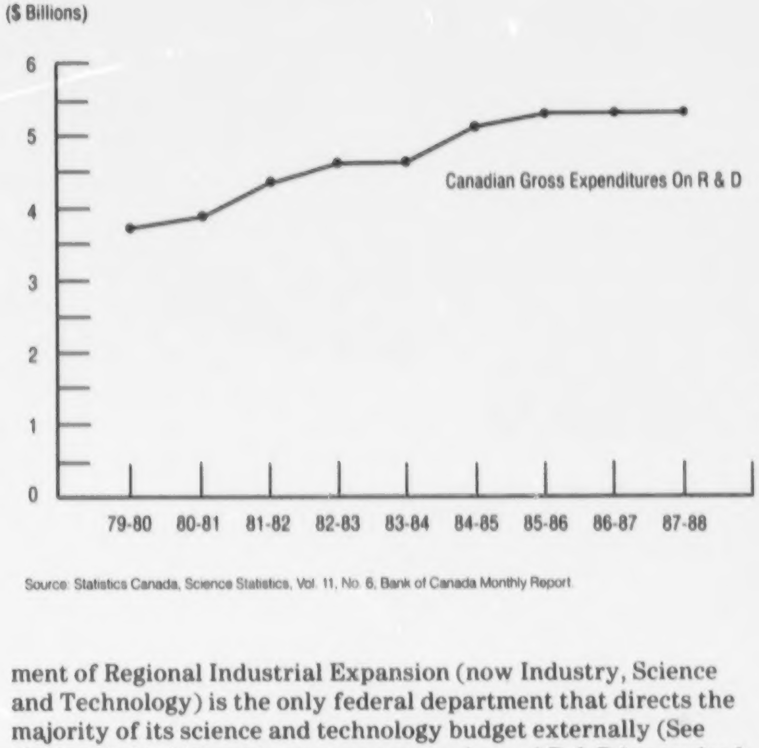
Canada's total expenditures on research and development have not increased (in constant dollars) since 1985 (See Exhibit C.3). This is the net result of Canadian industry expenditures on R & D increasing while public sector spending has declined. Overall, Canada's private and public sectors together are still lagging behind other nations in their investment in R & D. (A detailed comparison of Canada's R & D performance with that of seven other countries is provided in Appendix D).

FEDERAL GOVERNMENT INFRASTRUCTURE

The federal government is the largest R & D investor and performer in Canada, with a 1987-88 science and technology budget of $4.1 billion. Of this, $2.6 billion is allocated for research and development, while $1.5 billion is used for "related scientific activity", such as surveys, studies, and museum services (See Exhibit C.4). Most of the $4 billion is directed to internal government departments and labs, while 14 percent goes to industry and 15 percent to universities (See Exhibit C.5). With the exception of the pure granting agencies (the Natural Sciences and Engineering Research Council and the Medical Research Council), the Depart-

EXHIBIT C.3

CANADIAN SCIENCE AND TECHNOLOGY EXPENDITURES
Growth Of Total R & D Spending And Federal Government Spending
Deflated 1981
($ Billions)



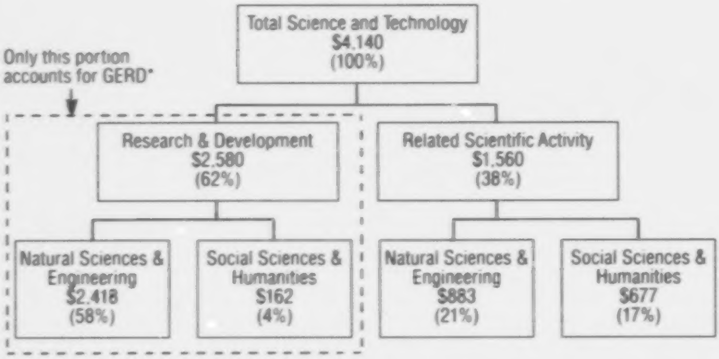
Source: Statistics Canada, Science Statistics, Vol. 11, No. 6, Bank of Canada Monthly Report.

ment of Regional Industrial Expansion (now Industry, Science and Technology) is the only federal department that directs the majority of its science and technology budget externally (See Exhibit C.6). Although government-performed R & D is required in areas where a clear national mission exists, such as environmental protection, the public sector has not proved an effective partner in carrying out industrial research (See Chapter IX, Volume I).

Analysis of government patents reveals that only 58 firms have licensed any of the approximately 1,000 federal government-held product and process patents (See Chapter V in this volume). By and large the industrial-oriented research done in government laboratories does not find direct application in industry. There are exceptions, of course, such as Lumonics, which licensed a government laser patent that became the foundation of its early

EXHIBIT C.4

FEDERAL SCIENCE AND TECHNOLOGY EXPENDITURES
1987
(Millions Of Dollars)

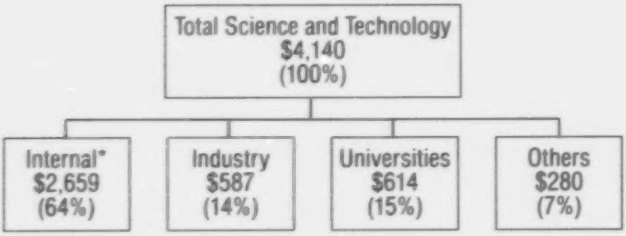

Total Science and Technology
$4,140
(100%)
Only this portion accounts for GERD*
Research & Development
$2,580
(62%)
Related Scientific Activity
$1,560
(38%)
Natural Sciences & Engineering
$2,418
(58%)
Social Sciences & Humanities
$162
(4%)
Natural Sciences & Engineering
$883
(21%)
Social Sciences & Humanities
$677
(17%)

*Gross Expenditures on Research and Development

Source: Statistics Canada, Federal Science Expenditures and Personnel, 1987-88

EXHIBIT C.5

FEDERAL SCIENCE AND TECHNOLOGY EXPENDITURES
By Performer
(Millions Of Dollars)
1987



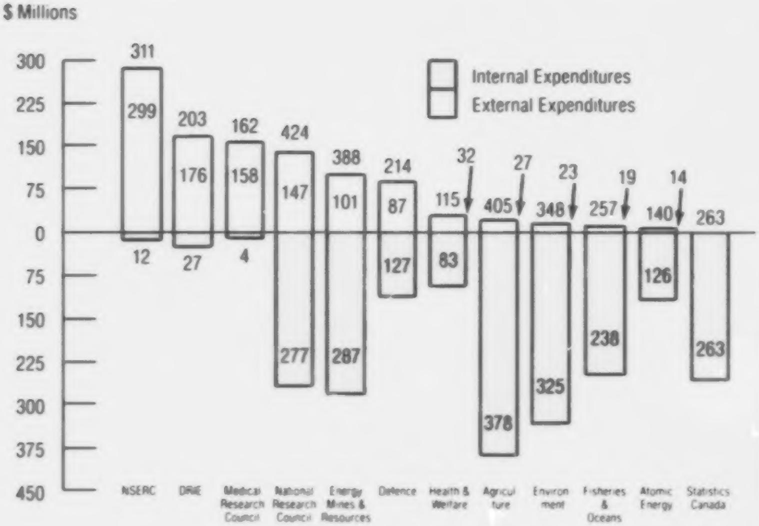
*Includes federal departments and laboratories

Source: Statistics Canada

EXHIBIT C.6

FEDERAL GOVERNMENT SCIENCE & TECHNOLOGY EXPENDITURES

Internal Versus External Spending
By Department*
1985-86



*Top 12 departments and agencies by total expenditures
Source: Canada Consulting Group based on Statistics Canada data

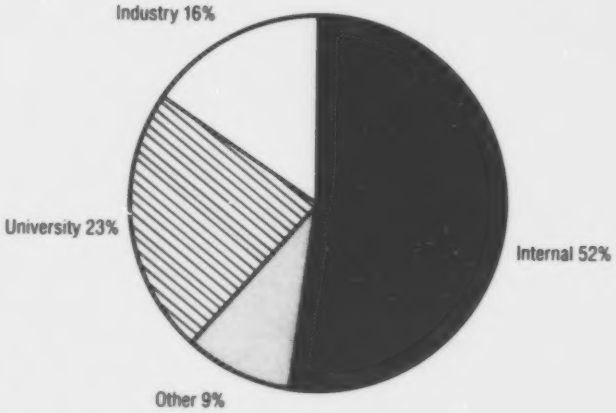
product line. But despite the occasional success story, most government industrial research assists industry only in more oblique ways, if at all.

Approximately ten percent of the federal government's science and technology budget goes in to the National Research Council. Two-thirds of the $424 million is allocated to NRC's own labs, and the balance goes to industry in the form of Industrial Research Assistance Program grants and funding for major projects and provincial research institutions.

The largest portion of funding for Canadian university R & D is granted through the Natural Sciences and Engineering Research Council (NSERC) in the amount of approximately $300 million per year. An additional $160 million is granted through the Medical Research Council under the auspices of the Department of National Health and Welfare.

EXHIBIT C.7

DISTRIBUTION OF ONTARIO SCIENCE AND TECHNOLOGY EXPENDITURES
NATURAL SCIENCES
1985-86
$153 Million



Source: *Scientific Activities of the Government of Ontario*, 1985-86, Statistics Canada

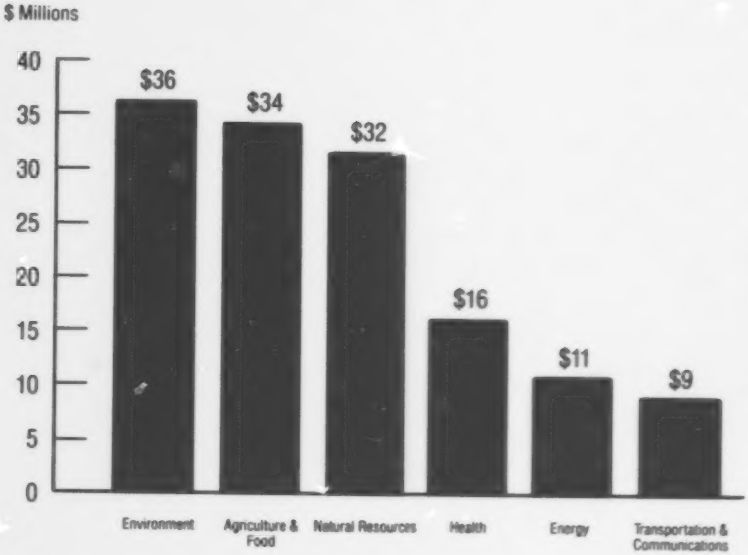
ONTARIO'S SCIENCE AND TECHNOLOGY INFRASTRUCTURE

The provinces have traditionally played a much smaller role in Canada's science and technology effort, accounting for less than ten percent of total R & D expenditures. In 1985-86 Ontario spent $234 million on science and technology, 65 percent of it in the natural sciences and 35 percent in the social sciences. Within the natural sciences $87 million was directed to R & D and $68 million to related scientific activity. Like the federal government, Ontario has tended to direct the majority of spending internally (See Exhibit C.7). In 1985-86, only 16 percent was directed to industry and 23 percent to universities.

Traditionally, Ontario government investment in science and technology has been in areas relevant to natural resources, including environmental protection, agriculture, and the resource industries (See Exhibit C.8). Premier's Council initiatives funded under the $1 billion Technology Fund, particularly the Centres of Excellence, are diversifying the scope of provincial R & D invest-

EXHIBIT C.8

DISTRIBUTION OF GOVERNMENT OF ONTARIO SCIENCE AND TECHNOLOGY EXPENDITURES
NATURAL SCIENCES-ORIENTED MINISTRIES
1985-86



Source: *Scientific Activities of the Government of Ontario*, 1985-86, Statistics Canada

ment to include new technological areas such as computers, advanced materials, and lasers.

UNIVERSITIES' ROLE IN THE PUBLIC INFRASTRUCTURE

Eighty-four percent of the $233 million in government support for Ontario university R & D in 1985-86 came from the federal government (See Exhibit C.9). Industry's role in funding university research is increasing slowly and in some universities has reached ten percent of total R & D funding.

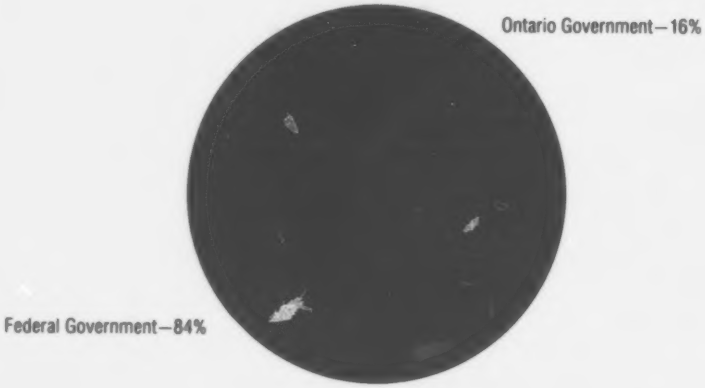
As is the case in government laboratories, much of the R & D performed in Ontario universities is not necessarily linked to needs of the private sector. With a few exceptions, university R & D rarely reaches the commercialization stage. Analysis of

EXHIBIT C.9

GOVERNMENT SCIENCE AND TECHNOLOGY EXPENDITURES IN ONTARIO UNIVERSITIES*

1985-86

$233 Million



*R & D grants, contract and fellowships

Source: Statistics Canada, Federal Science Activities, 1985-86; *Scientific Activities of the Government of Ontario*, 1985-86.

university licensing and patent data indicates that, out of a total research budget of more than $350 million, Ontario's eleven largest universities earned less than $3 million in licence fees and royalties in 1986 (See Chapter V in this volume). Furthermore, two-thirds of the fees earned were generated by one university, the University of Waterloo (which received less than ten percent of the total provincial research budget). Of course, the university system has as its primary goal the development of basic research and high quality graduates. As discussed in Chapter IX of Volume I, attempts to make universities into surrogates for industrial R & D that really should be conducted in the private sector is a chronic Canadian problem and should be remedied.

APPENDIX D
CANADA'S PERFORMANCE ON INTERNATIONAL SCIENCE AND TECHNOLOGY INDICATORS

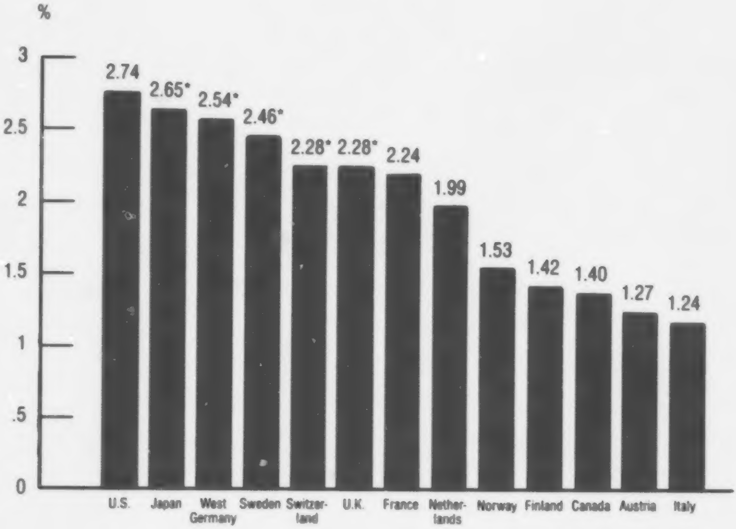
In Chapter IX of Volume I, a number of international comparisons of science and technology expenditures and performance are summarized. They show Canada ranking much lower than other nations of comparable population and wealth.

In this appendix, the comparative ranking of Canada in terms of a number of science and technology indicators is portrayed in eleven exhibits.

These exhibits amplify the description of Canada's poor science and technology performance provided in Volume I and in Chapter V of the present volume.

EXHIBIT D.1

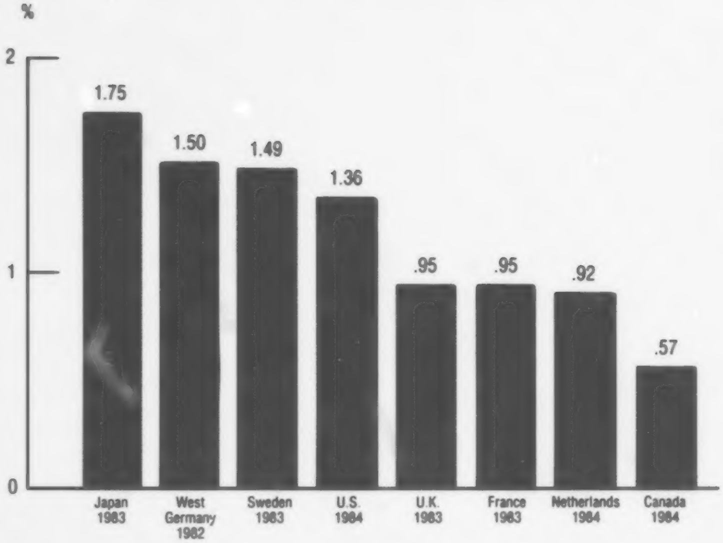
GROSS R & D EXPENDITURES AS A PERCENTAGE OF GDP
1984



*1983 data.
Source: OECD, Recent Results, 1979-86; OECD, Main Economic Indicators, March 1986.

EXHIBIT D.2

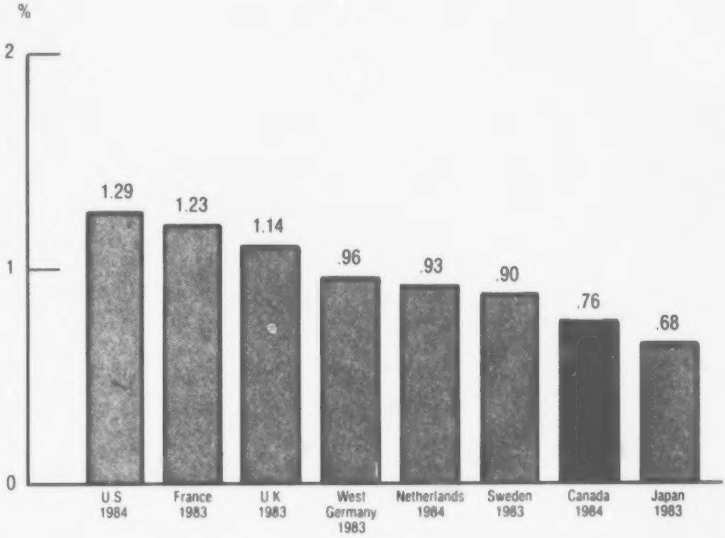
INDUSTRY-FUNDED R & D AS A PERCENTAGE OF GDP



Source: OECD, Recent Results, 1979-86; OECD, Main Economic Indicators, March 1986

EXHIBIT D.3

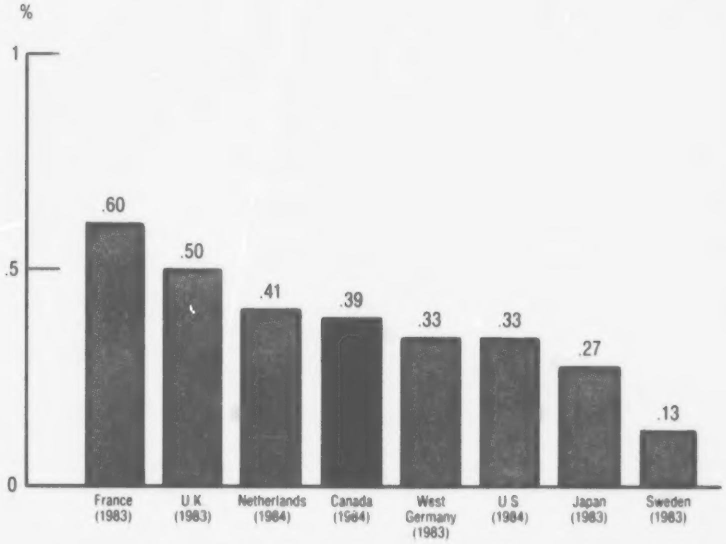
GOVERNMENT-FUNDED R & D AS A PERCENTAGE OF GDP



Source OECD Recent Results 1979 86 OECD Main Economic Indicators March 1986

EXHIBIT D.4

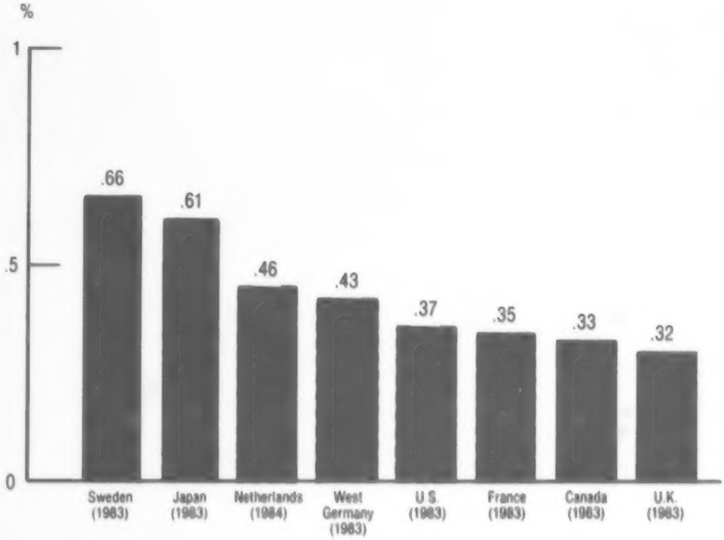
GOVERNMENT-PERFORMED R & D AS A PERCENTAGE OF GDP



Source OECD, Recent Results 1979-86

EXHIBIT D.5

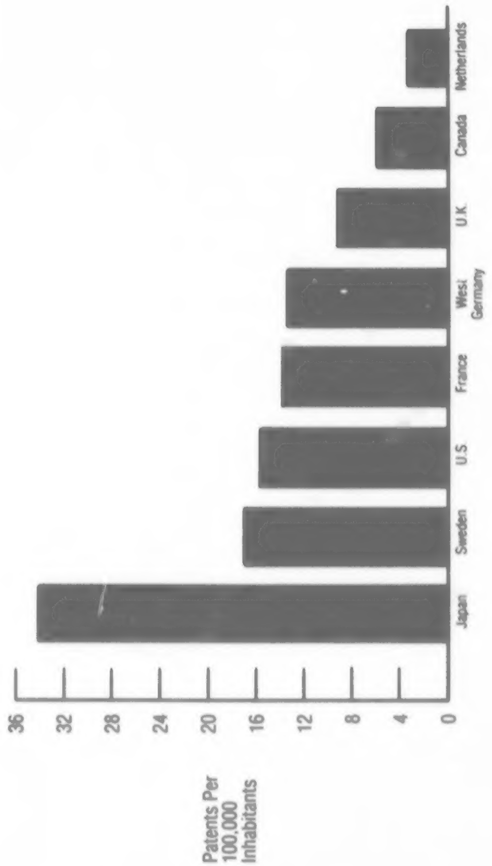
HIGHER EDUCATION R & D EXPENDITURES AS A PERCENTAGE OF GDP



Source: OECD, Recent Results 1979-86

EXHIBIT D.6

AVERAGE ANNUAL NUMBER OF PATENTS GRANTED TO RESIDENTS PER 100,000 INHABITANTS
1980-82

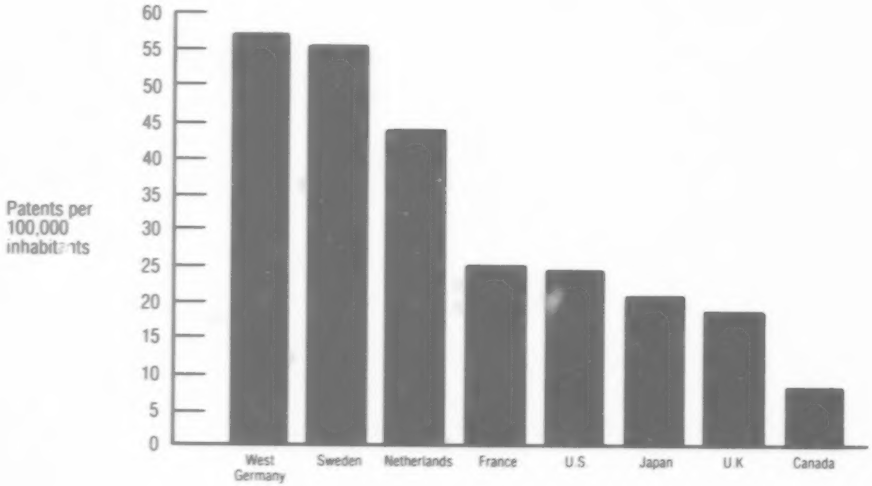


Source: Canada Consulting Group, based on European Management Forum Foundation, World Economic Forum, *Report on International Competitiveness*, 1985

EXHIBIT D.7

INTERNATIONAL OWNERSHIP OF TECHNOLOGY

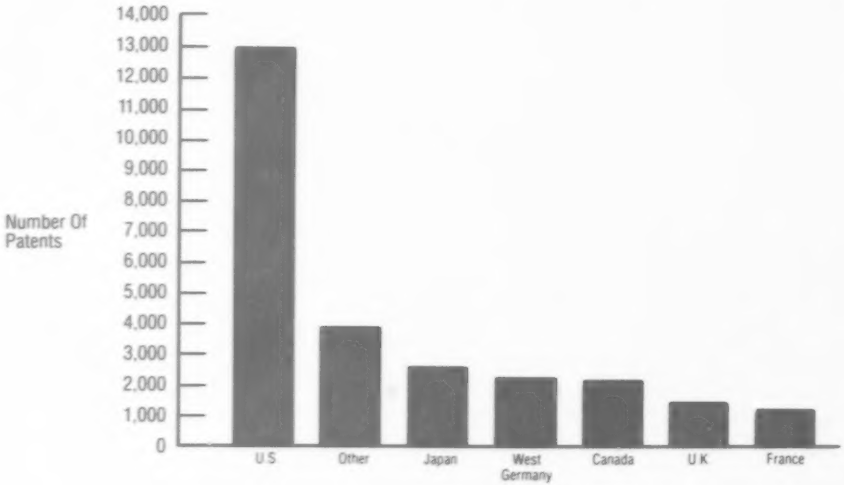
Number Of Patents Secured By Residents Of A Country In The Rest of The World (i.e., External Patents) Per 100,000 Inhabitants
1982



Source Canada Consulting Group, based on European Management Forum Foundation, World Economic Forum, *Report on International Competitiveness*, 1985

EXHIBIT D.8

PATENT APPLICATIONS FILED IN CANADA
By Country Of Inventor
1984

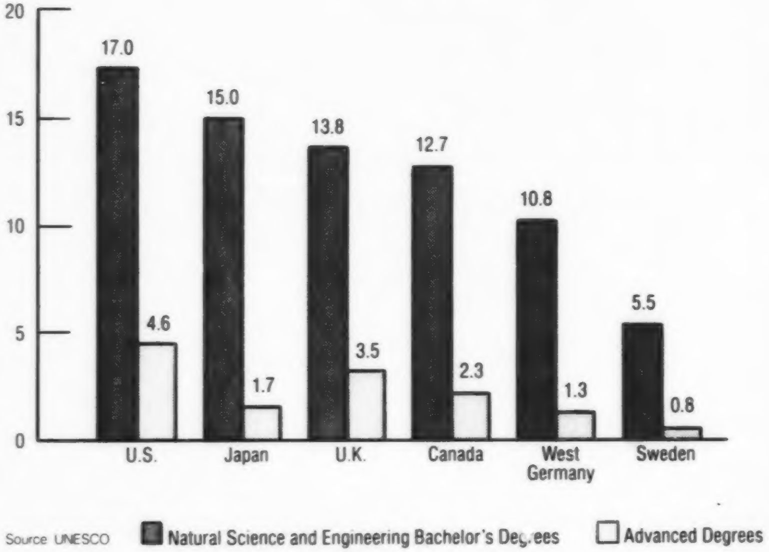


Source: Canada Consulting Group, based on Industrial Property Statistics, World Intellectual Property Organization, Geneva

EXHIBIT D.9

ADVANCED DEGREES AND NATURAL SCIENCE AND ENGINEERING BACHELOR'S DEGREES AWARDED

(Degrees per 10,000 Participants in Labour Force—1982)



Source UNESCO

EXHIBIT D.10

TOTAL RESEARCH SCIENTISTS AND ENGINEERS
Per Thousand Labour Force Participants, 1983

Country	Research Scientists and Engineers
Japan	7.4
United States	6.4
West Germany	4.8
France	3.9
Sweden	3.9
Netherlands	3.7
Canada	**2.7**

Source: OECD, Recent Results, 1979-86. The OECD notes that the Japanese data are likely over-estimated. No data are available for the U.K.

EXHIBIT D.11

TRADE BALANCE OF MANUFACTURING INDUSTRIES ACCORDING TO THEIR R & D INTENSITY*
1970-84

	High Intensity	Medium Intensity	Low Intensity
Japan	Positive	Positive	Positive
United States	Positive	Positive	Negative
West Germany	Positive	Positive	Positive
France	Positive	Positive	Negative
United Kingdom	Positive	Positive	Negative
Netherlands	Negative	Positive	Positive
Sweden	Negative	Positive	Positive
Canada	**Negative**	**Negative****	**Positive**

* R & D Intensity is measured by R & D expenditure/output. High-intensity industries have a higher than 10% measure; medium intensity is 1-10%; and low intensity is less than 1%.

** Positive since 1981.

Source: OECD Science and Technology Indicators, 1986.